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ECODRIVE03
Drive For General Automation with Fieldbus-Interfaces

Functional Description: FGP 02VRS

DOK-ECODR3-FGP-02VRS**-FKB1-EN-P

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What is the purpose of this documentation?

The following documentation describes the functions of the firmware FWA-ECODR3-FGP-02VRS-MS.

This documentation serves trained maintenance personnel:

- for Description of all functional features
- for parameterization of the drive controller
- for data security of the drive parameter
- for error diagnosis and error removal

Course of modifications

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Supplement B: Diagnostic Message Description

Supplement C: Serial Communications

Customer Service Locations

Notes

1 System Overview

1.1 ECODRIVE03 - the Universal Drive Solution for Automation

The universal automation system **ECODRIVE03** is an especially cost-effective solution for drive and control tasks.

Exceptional power data, extensive functions and an excellent price-performance ratio are characteristic of this system.

The servo drive system ECODRIVE03 features:

- a very broad implementation range
- extensively integrated functionalities
- a highly favorable price/performance ratio

ECODRIVE03 can be used to implement numerous drive tasks in the most varying of applications. Typical applications are:

- machine tools
- printing and paper processing machines
- handling systems
- packaging and food processing machines
- handling and assembly systems

1.2 ECODRIVE03 - a Drive Family

FWA-ECODR3-FGP-0xVRS-MS

In addition to the here documented firmware FWA-ECODR3-FGP-0xVRS-MS drive for general automation with fieldbus interfaces, there are also two additional application-related firmware variants.

FWA-ECODR3-SMT-0xVRS-MS

- drive for machine tool applications with SERCOS, analog and parallel interface

FWA-ECODR3-SGP-0xVRS-MS

- drive for general automation with with SERCOS, analog and parallel interface

1.3 Drive Controllers and Motors

Available controllers

The drive controller family of the **ECODRIVE03** generation is at present made up of 6 different units. These differentiate primarily in terms of which interface is used command communications (SPS, CNC). The drive controller have two power stages, i.e., with 40A and 100A peak currents.

Six different interfaces are supported:

- DKC 1.3 Parallel interface (EAK)
- DKC 2.3 SERCOS interface (SCK02)
- DKC 3.3 Profibus interface (PBK02)
- DKC 11.3 Analog interface
- DKC 5.3 CANopen interface (CAN 01)
- DKC 4.3 Interbus interface (ITB 01)

Supported motor types

With **ECODRIVE03** firmware it is possible to operate

- synchronous motors for standard applications up to 48 Nm.
- synchronous motors for increased demands of up to 64 Nm.
- asynchronous motors for main spindle applications
- asynchronous kit motors
- linear synchronous and asynchronous motors



Abb. 1-1: Units and motors supported by the ECODRIVE03 family

1.4 Function Overview: FWA-ECODR3-FGP-02VRS-MS

Command Communications Interface

- Profibus S- interface
- CAN-open- interface
- Interbus- interface
- Analog- interface

Possible Operating Modes

- Operating mode
- Position target default (DRIVECOM profile 22)
- Velocity control 2 (DRIVECOM profile 22)
- I/O - mode (functionally compatible with DKC3.1)
- I/O - mode (functionally compatible with DKC3.1) with configurable real time data
- I/O - mode with cam status bits
- drive-internal interpolation
- cyclical position control
- velocity control
- freely-configurable modes (without profile!)

Supported Types of Motors

- MKD
- 2AD
- 1MB
- LAF
- MKE
- Rotary synchronous kit motor
- MHD
- ADF
- MBW
- LAR
- Linear synchronous kit motor

Supported Measuring Systems

- HSF/LSF
- sine encoder with 1Vss signals
- encoder with ENDAT-Interface
- resolver without feedback data memory
- resolver with feedback data memory
- resolver without feedback data memory with incremental sine encoder
- gearwheel encoder with 1Vss signals

Which combination is possible, is outlined in section: "Programming the measuring system".

General Functions

- Extensive diagnostics options
- Basic parameter block that can be activated for a defined setting of the drive parameters to default values.
- Customer passwords
- List of password-protected data
- Error memory and operating hour counter
- Supports five (5) languages for parameter names and units and diagnoses (S-0-0095)
  - German
  - English
  - French
  - Spanish
  - Italian
- Settable drive-internal position resolution
- Evaluation of option (load-side) encoder for position and/or velocity control
- Evaluates absolute measuring system with setting of absolute dimension
- Modulo function
- Parametrizable torque limit
- Current limit
- Velocity limit
- Travel range limit:
  via travel range limit switch and/or position limit values
- Drive-side error reactions:
  error reaction "return limit"
  best possible standstill "velocity command to zero"
  best possible standstill "Torque free"
  best possible standstill "velocity command to zero with ramp and filter
  power shutdown with fault
  E-Stop function
- Control loop settings
  base load function (feedback memory read out)
  acceleration precontrol
  velocity mix factor (with external encoder)
  velocity precontrol
  automatic control loop settings
- Velocity control loop monitor
- Position control loop monitor
- Drive halt

- Drive-Controlled Homing
- Command "Set Absolute Measuring"
- 2 Analog outputs
- Analog input
- Oscilloscope function
- Probe function
- Command park axes
- Command "Detect marker position“
- Programmable Limit Switch
- Encoder emulation

  absolute encoder emulation (SSI format)

  incremental encoder emulation

Notes

2 Safety Instructions for Electrical Drives

2.1 Introduction

These instructions must be read and understood before the equipment is used to minimize the risk of personal injury and /or property damage. Follow these safety instructions at all times.

Do not attempt to install, use or service this equipment without first reading all documentation provided with the product. Please read and understand these safety instructions, and all user documentation for the equipment, prior to working with the equipment at any time. You must contact your local Indramat representative if you cannot locate the user documentation for your equipment. A listing of Indramat offices is supplied in the back of this manual. Request that your representative send this documentation immediately to the person or persons responsible for the safe operation of this equipment.

If the product is resold, rented and/or otherwise transferred or passed on to others, these safety instructions must accompany it.



WARNING

Improper use of this equipment, failure to follow the attached safety instructions, or tampering with the product, including disabling of safety device, may result in personal injury, severe electrical shock, death, or property damage!

2.2 Hazards by improper use



DANGER

High Voltage and high discharge current!

Danger to life, risk of severe electrical shock and risk of injury!



DANGER

Dangerous movements!

Danger to life and risk of injury or equipment damage by unintential movements of the motors!



WARNING

High electrical voltages due to incorrect connections!

Danger to life and limb, severe electrical shock and serious bodily injury!



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!



CAUTION

Risk of injury due to incorrect handling!

Bodily injury caused by crushing, shearing, cutting, and thrusting movements!



CAUTION

Risk of injury due to incorrect handling of batteries!

2.3 General

- INDRAMAT GmbH is not liable for damages resulting from failure to observe the warnings given in these instructions.
- Operating, maintenance and safety instruction in the english language must be ordered and received before initial start-up, if the instructions in the language provided are not understood perfectly.
- Proper and correct transport, storage, assembly, and installation as well as care in operation and maintenance are prerequisites for optimal and safe operation of this equipment.
- Trained and qualified personnel in electrical equipment:

  Only trained and qualified personnel may work on this equipment or in its vicinity. Personnel are qualified if they have sufficient knowledge of the assembly, installation, and operation of the product as well as of all warnings and precautionary measures noted in these instructions.

  Furthermore, they should be trained, instructed, and qualified to switch electrical circuits and equipment on and off, to ground them, and to mark them according to the requirements of safe work practices and common sense. They must have adequate safety equipment and be trained in first aid.
- Use only spare parts approved by the manufacturer.
- All safety regulations and requirements for the specific application must be followed as practiced in the country of use
- The equipment is designed for installation on commercial machinery.
- Start-up is only permitted once it is sure that the machine in which the products are installed complies with the requirements of national safety regulations and safety specifications of the application.

  European countries: see Directive 89/392/EEC (Machine Guideline);
- Operation is only permitted if the national EMC regulations for the application are met.

  The instructions for installation in accordance with EMC requirements can be found in the INDRAMAT document "EMC in Drive and Control Systems“.

  The machine builder is responsible for the adherence of the limiting values as prescribed in the national regulations and specific regulations for the application concerning EMC.

  European countries: see Directive 89/336/EEC (EMC Guideline);

  U.S.A.: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.
- Technical data, connections, and operational conditions are specified in the product documentation and must be followed.

2.4 Protection against contact with electrical parts and not grounded enclosures

Note: This section pertains to equipment and drive components with voltages over 50 Volts.

Touching live parts with potentials of 50 Volts and higher applied to them or touching not grounded enclosures can be dangerous and cause severe electrical shock. In order for electrical equipment to be operated, certain parts must have dangerous voltages applied to them.



DANGER

High Voltage!
Danger to life, severe electrical shock and risk of injury!

⇒ Only those trained and qualified to work with or on electrical equipment are permitted to operate, maintain and/or repair this equipment.

⇒ Follow general construction and safety regulations when working on electrical installations.

⇒ Before switching on power, the ground wire must be permanently connected to all electrical units according to the connection diagram.

⇒ At no time may electrical equipment be operated if the ground wire is not permanently connected, even for brief measurements or tests.

⇒ Before beginning any work, disconnect mains or the voltage source from the equipment. Lock the equipment against being switched on while work is being performed.

⇒ Wait 5 minutes after switching off power to allow capacitors to discharge before beginning work. Measure the voltage on the capacitors before beginning work to make sure that the equipment is safe to touch.

⇒ Never touch the electrical connection points of a component while power is turned on.

⇒ Before switching the equipment on covers and guards provided with the equipment must be installed to prevent contact with live parts. Before operating cover and guard live parts properly so they cannot be touched.

⇒ An residual-current-operated protective device (r.c.d.) must not be used for an AC drive! Indirect contact must be prevented by other means, for example, by an overcurrent protective device.

European countries: according to EN 50178/ 1994;

⇒ Electrical components with exposed live parts must be installed in a control cabinet to prevent direct contact.

European countries: according to EN 50178/ 1994;

U.S.A: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.



DANGER

High housing voltage! High leakage current!
Danger to life and limb, danger of injury from electric shock!

⇒ Prior to powering up, connect the electrical equipment, the housing of all electrical units and motors to the protective conductor at the grounding points or ground them. This applies even to brief tests.

⇒ The protective conductor of the electrical equipment and units must always be connected to the supply network. Leakage current exceeds 3.5 mA.

⇒ Use at least a 10 mm^2 copper conductor cross section for this protective connection over its entire course!

⇒ Prior to startups, even for brief tests, always connect the protective conductor or connect with ground wire. High voltage levels can occur on the housing that could lead to severe electrical shock and personal injury.

European countries: EN 50178 / 1994, section 5.3.2.3.

USA: See National Electrical Codes (NEC), National Electrical Manufacturers Association (NEMA), and local building codes. The user of this equipment must consult the above noted items at all times.

2.5 Protection by protective low voltage (PELV) against electrical shock

All connections and terminals with voltages ranging between 5 and 50 volts on INDRAMAT products are protective low voltages designed in accordance with the following standards on contact safety:

- International: IEC 364-4-411.1.5
- European countries within the EU: see EN 50178/1994, section 5.2.8.1.



WARNING

High electrical voltages due to incorrect connections!
Danger to life and limb, severe electrical shock and/or serious bodily injury!

⇒ Only that equipment or those electrical components and cables may be connected to all terminals and clamps with 0 to 50 volts if these are of the protective low voltage type (PELV = Protective Extra Low Voltage).

⇒ Only connect those voltages and electrical circuits that are safely isolated. Safe isolation is achieved, for example, with an isolating transformer, an optoelectronic coupler or when battery-operated.

2.6 Protection against dangerous movements

Dangerous movements can be caused when units have bad interfaces or motors are connected incorrectly.

There are various causes of dangerous movements:

- Improper or incorrect wiring or cable connections
- equipment is operated incorrectly
- probe parameters or encoder parameters are set incorrectly
- broken components
- errors in software or firmware

Dangerous movements can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

Although the monitoring circuits in the drive components make improper operation almost impossible, personnel safety requires that proper safety precautions be taken to minimize the risk of personal injury and/or property damage. This means that unexpected motion must be anticipated since safety monitoring built into the equipment might be defeated by incorrect wiring or other faults.



DANGER

Dangerous movements!
Danger to life and risk of injury or equipment damage!

⇒ In the drive component monitoring units, every effort is made to avoid the possibility of faulty operation in connected drives. Unintended machine motion or other malfunction is possible if monitoring units are disabled, bypassed or not activated.

⇒ Safe requirements of each individual drive application must be considered on a case-by-case basis by users and machine builders.

Avoiding accidents, personal injury and/or property damage:

⇒ Keep free and clear of the machine's range of motion and moving parts. Prevent people from accidentally entering the machine's range of movement:
- use protective fences
- use protective railings
- install protective coverings
- install light curtains

⇒ Fences should be strong enough to withstand maximum possible momentum.

⇒ Mount the Emergency Stop (E-Stop) switch in the immediate reach of the operator. Verify that the Emergency Stop works before startup. Do not use if not working.

⇒ Isolate the drive power connection by means of an Emergency Stop circuit or use a safe lock-out system to prevent unintentional start-up.

⇒ Make sure that the drives are brought to standstill before accessing or entering the danger zone.

⇒ Disconnect electrical power to the equipment using a master lock-out and secure against reconnection for:
- maintenance and repair work
- cleaning of equipment
- long periods of discontinued equipment use

⇒ Avoid operating high-frequency, remote control, and radio equipment near equipment electronics and supply leads. If use of such equipment cannot be avoided, verify the system and the plant for possible malfunctions at all possible positions of normal use before the first start-up. If necessary, perform a special Electromagnetic Compatibility (EMC) test on the plant.

2.7 Protection against magnetic and electromagnetic fields during operations and mounting

Magnetic and electromagnetic fields in the vicinity of current-carrying conductors and permanent motor magnets represent a serious health hazard to persons with heart pacemakers, metal implants and hearing aids.



WARNING

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!

⇒ Persons with pacemakers and metal implants are not permitted to have access to the following areas:

- Areas in which electrical equipment and parts are mounted, operating or are being commissioned.
- Areas in which parts of motors with permanent magnets are being stored, repaired or mounted.

⇒ If it is necessary for a person wearing a heart pacemaker to enter into such an area then a physician must be consulted prior to doing so.

⇒ Persons with metal implants or hearing aids must take care prior to entering into areas described above. It is assumed that metal implants or hearing aids will be affected by such areas and a physician must be consulted prior to doing so.

2.8 Protection against contact with hot parts



CAUTION

Surface of machine housing could be extremely hot! Danger of injury! Danger of burns!

⇒ Do not touch housing surface near the source of heat! Danger of burns!

⇒ Prior to accessing a unit, wait 10 minutes to allow the unit to cool off.

⇒ If hot parts of the equipment such as unit housing in which heatsink and resistor are located, then this can cause burns.

2.9 Protection during handling and installation

All INDRAMAT products should be handled and assembled according to the instructions in the documentation.



CAUTION

Risk of injury due to incorrect handling!
Bodily injury caused by crushing, shearing, cutting, and thrusting movements!

⇒ Observe installation instructions and safety regulations before handling and working on the product.

⇒ Use suitable installation in using lifting or moving equipment. Refer to the user manual for the product.

⇒ Take precautions to avoid pinching and crushing.

⇒ Only use suitable tools specified in the user manuals and use them according the instructions.

⇒ Use lifting devices and tools correctly and safely.

⇒ Wear appropriate protective clothing, e.g., protective goggles, safety shoes, protective gloves.

⇒ Never stand under suspended loads.

⇒ Clean up liquids form the floor to prevent personnel from slipping.

2.10 Battery safety

Batteries contain reactive chemicals. Incorrect handling can result in injury or equipment damage.



CAUTION

Risk of injury due to incorrect handling!

⇒ Do not attempt to reactivate dead batteries by heating or other methods (danger of explosion and corrosion).

⇒ Never charge batteries (danger from leakage and explosion).

⇒ Never throw batteries into a fire.

⇒ Do not take batteries apart.

⇒ Handle carefully. Incorrect extraction or installation of a battery can damage equipment.

Note: Environmental protection and disposal! The batteries contained in the product should be considered as hazardous material for land, air, and sea transport in the sense of the legal requirements (Danger of explosion). Dispose of batteries separately from other refuse. Observe the legal requirements in the country of installation.

3 General Instructions for Installation

3.1 Definition of Terms, Introduction

It is helpful to explain the terms used in this document so that they will be better understood.

Parameter

Communication with the drive occurs (with a few exceptions) with the help of parameters.

They can be used for

- Setting the configuration
- Parameterizing the control/drive settings
- Accessing control/drive functions and commands
- Cyclical or acyclical (depending on requirements) transmission of command and actual values

Note: All of the drive's operating data are identified by ID numbers.

The Data Status

Each parameter is provided with a data status, which can also be read. It serves the following purposes:

- Identifying the validity/invalidity of the parameter
- Contains the command acknowledgment if the parameter acts as a command

(see also Commands)

Paramter structure

There are seven different data block elements for each parameter. These can be read/write accessed either via a user data interface by a higher-ranking control or a parametrization surface.

Element No.:	Designation:	Remarks:
1	ID Number	Parameter identification
2	Name	can be changed in language selection
3	Attribute	contains data length, type and decimal places
4	Unit	can be changed in language selection
5	Minimum Input Value	contains the minimum input value of the operating data
6	Maximum Input Value	contains the maximum input value of the operating data
7	Operating Data	actual parameter value

Fig. 3-1: Data blocks or parameter structure

Write Accessibility

Only the operating data can be changed; all other elements can only be read.

The operating data can be write-protected either continuously or temporarily.

The write accessing of the operating data depends on the relevant communications phase.

Possible Error Messages when Reading and Writing Operating Data

Error:	Reason:
0x7002, data transmitted too short	
0x7003, data transmitted too long	
0x7004, Data not changeable	The operating data is write-protected
0x7005, Data currently write-protected	The operating data cannot be written to in this communication phase (see Supplement A:Parameterdescription)
0x7006, Data smaller than minimum value	The operating data is smaller than its minimal input value
0x7007, Data larger than maximum value	The operating data is larger than its maximum input value
0x7008, Data is not correct	The value could not be accepted as written because internal tests lead to a negative result
0x7009, data write protected with password	The parameter cannot be write accessed as the customer password was activated in parameter **S-0-0267, Password**. All parameters listed in S-0-0192, IDN-list of backup operation data are therefore locked.

Fig. 3-2: Error messages while reading/writing operating data

Data Storage

Non-Volatile Parameter Storage Registers

Various non-volatile parameter storage registers that buffer operating data are contained in the drive.

The operating data apply to:

- setting the configuration or
- parameterizing the control drive settings

Each time operating data is written to it is stored.

The following modules contain non-volatile memory:

- Control drive
- Motor feedback (optional)
- Programming module

Parameters Stored in the Digital Drive

All operating data that apply only to the drive controller and that cannot be changed by the user are stored in the digital drive. This consists of the following parameters:

- **S-0-0110, Amplifier Peak Current**
- **S-0-0112, Amplifier Nominal Current**
- **S-0-0140, Controller Type**
- **P-0-0518, Amplifier Nominal Current 2**
- **P-0-0519, Amplifier Peak Current 2**
- **P-0-4002, Current-Amplify-Trim Phase U**
- **P-0-4003, Current-Amplify-Trim Phase V**
- **P-0-4015, Intermediate Voltage**
- **P-0-4035, Trim-Current**
- **P-0-04058, Amplifier, A resistor data**
- **P-0-4059, Braking resistor data**

Parameter Storage in Motor Feedback

All motor-dependent parameters are stored in the motor feedback with MHD, MKD and MKE motors.

Additionally, parameters for the "load default" function and the motor feedback are stored here.

All parameters stored in the motor feedback data memory are there with both parameter block number 0 and 7.

In parameter block 7 (e.g., S-7-0100) the original data without write access are stored in the motor feedback data memory. These are copied after powering up into the parameters of parameter block 0 (e.g., S-0-0100) .

Note: The parameters of parameter block 0 take effect.

Parameters Stored in DSM Programming Module

All application parameters are stored in the programming module (control loop, mechanical system, interface parameters and so on).

All ID numbers backed up in this module are listed in parameter **S-0-0192, IDN-list of backup operation data**.

If the programming module is exchanged then these application parameters must be read out before hand so that they can be written into the new module after the exchange.

Note: By switching the programming module when devices are exchanged, the characteristics of the device that has been exchanged can be easily transferred to the new device.

Data Saving

To save the data of the axis, all important and changeable parameters of the axis are stored in the list **S-0-0192, IDN-List of backup operation data**. By saving the parameters listed there with the control or parametrization surface, you can obtain a complete data backup of this axis after the first setup (Backup&Restore-function).

Parameter Buffer Mode

The drive controller is capable of storing data that is transmitted via the user data channel (e.g., service channel) either temporarily or permanently.

Note: Parameter **S-0-0269, Parameter buffer mode** is insignificant as of version FGP-02VRS as all the parameters are backed up from that point on in a NOVRAM.

Basic parameter block

The drive parameters are set to default values at the factory. By executing the command **P-0-4094, C800 Command Base-parameter load** it is possible to reproduce this state at any time. The default parameter set is constructed so that

- all important monitoring functions are activated
- all optional drive functions are deactivated
- limit values for position are deactivated
- limit values for torque/force are set to high values and
- limit values for velocity and acceleration are set to lower values

The set mode is positioning block mode.

Note: The default parameter set does not guarantee a matching of the drive to the machine. The relevant settings must be made when first starting up the axis.

See also: Basic drive functions and Commissioning Guidelines.

Running the "load basic parameter block" function automatically

Drive firmware is stored on the programming module. In the event of a firmware exchange, the drive controller will detect this the next time the machine is switched on. In this case, the message "**PL**" appears on the 7-segment display. By pressing the "S1" key, the function default parameter set is activated.

Note: Any previous parameter settings are lost with the replacement of the firmware followed by "load base parameter block". If this is to be prevented, then the parmeters must be stored prior to an exchange and must be reloaded after exchange and load default parameter set .

Password

All important axis-specific parameters are stored in the programming module. If, e.g., a controller is replaced because of a defect then the features can be transferred to the new controller by simply using the old module.

S-0-0279, IDN-list of password-protected operation data

The affected parameters are stored in **S-0-0279, IDN-list of password-protected operation data.** To secure these parameters against unwanted or non-authorized changes, the customer password can be activated.

By editing **S-0-0279, IDN-list of password-protected operation data** the user can select the parameter which are to be protected with a password.

Note: The default value of **S-0-0279, IDN-list of password-protected operation data** corresponds to the contents of **S-0-0192, IDN-list of backup operation data**.

Accessing the password

The password is accessed with parameter **S-0-0267, Password**.

Allowable symbols and length

The password has to have:

- at least 3 symbols
- no more than ten symbols
- can only use the letters a - z and A - Z
- and the numbers 0 to 9.

3 different password states are possible

The password function can have three different states. Depending on the sequence of symbols entered for **S-0-0267** the current password status can be changed.

The following illustrates possible password states and the symbol sequence for parameter **S-0-0267**.

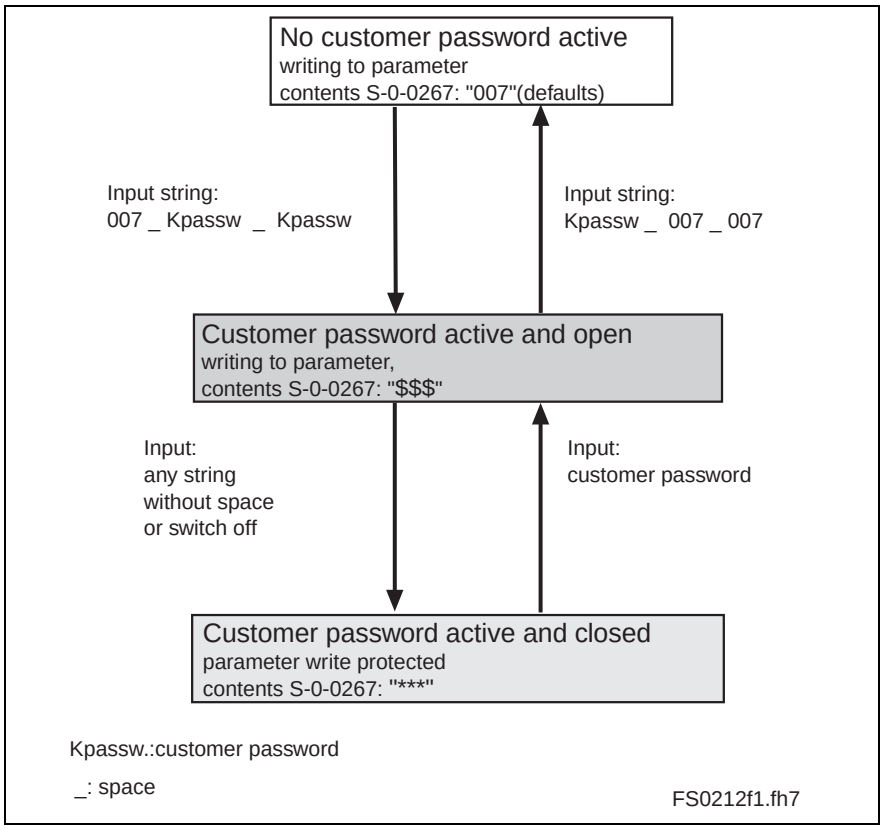


Fig. 3-3: Possible password states

Note: If the user's password is activated and unlocked (content of S-0-0267= "$$$"), then the drive is locked after switching the machine off (contents of S-0-0267= "***").

Note: Parameters stored in the motor feedback or drive controller data memory can generally not be changed by the user.

Master password

Indramat retains the rights to the master password function.

Commands

Commands are used to control complex functions in the drive. For example, the functions "Drive-Controlled Homing Procedure" or "Transistion Check for Communication Phase 4" are defined as commands.

Each command that is started must also be cleared.

A primary control can start, interrupt or erase a command.

Each command has a parameter with which the command can be controlled.

While a command is being executed, the diagnostic message "Cx" or "dx" appears in the H1 display, where x is the number of the command.

list of all procedure commands

All commands used are stored in parameter **S-0-0025, IDN-list of all procedure commands.**

Command Types

There are 3 command types.

- **Drive-Controlled Command**
  - Eventually leads to an automatic drive operation or motion
  - Can be started only when controller enable is set
  - Deactivates the active operating mode during its operation
- **Monitor Command**
  - Activates or deactivates monitors or features in the control drive
- **Management Command**
  - executes management tasks; is not interruptable

Command Input and Acknowledgment

Control and monitoring of command execution occurs via the command input and command acknowlegment. The command input tells the drive if the command should be started, interrupted or ended. The commanded value is the operating data of the applicable parameter. The command input value can be:

- not set and enabled (0)
- interrupted (1)
- set and enabled (3)

In the acknowledgement, the drive informs about the extent to which a command has been executed. This is then displayed in the data status of the command parameter.

Also see: "Data block structure".

Note: The command status can be obtained by conducting a write error on parameter element 1 (data status).

The condition can be:

- not set and enabled (0)
- in process (7)
- error, command execution not possible (0xF)
- command execution interrupted (5)
- command properly executed (3)

Change Bit Command

The Change Bit Command in the Drive Status Word helps the control recognize a change in the command acknowledgment by the drive. The bit is set by the drive if the command acknowledgment changes from the condition in process (7) to the condition error, command execution not possible (0xF) or command properly executed (3). The bit is cleared if the master clears the input (0).

The control system will recognize if the drive sets the Command Change Bit bit command. It can read the corresponding data status of the command or the command itself, which was set sometime but has not been cleared. The control system will recognize from this if the command ended with or without an error in the drive. Afterwards this command should be cleared by the control.

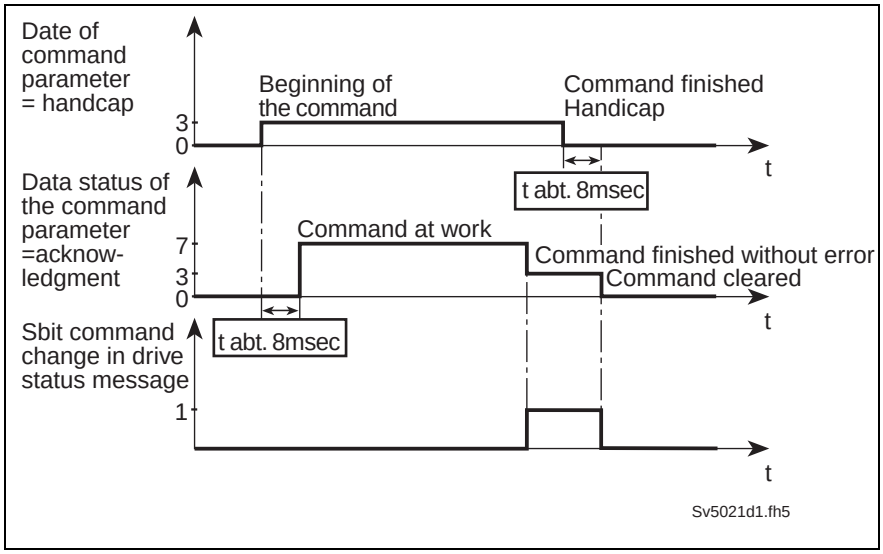


Fig. 3-4: Input, acknowledgment and Command Change Bit during proper execution

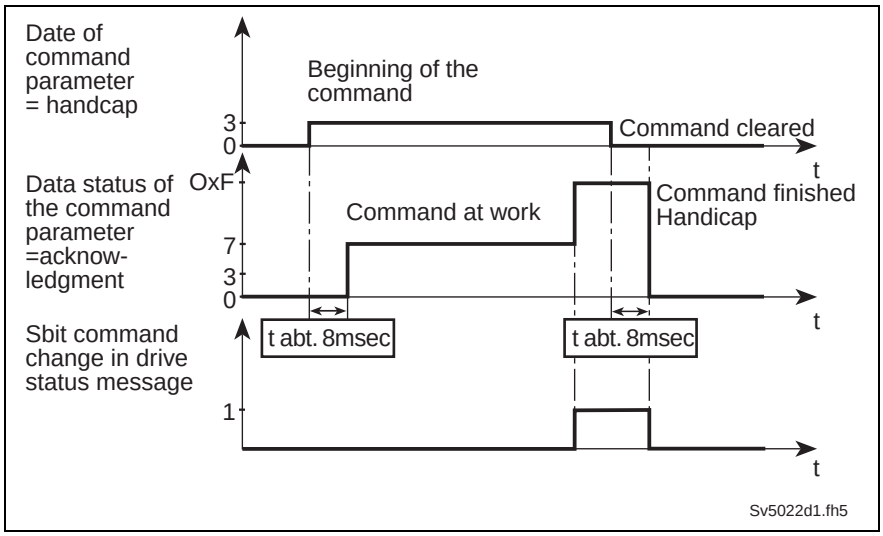


Fig. 3-5: Input, acknowledgment and Command Change Bit during erroneous execution

A delay time of up to 8ms can occur in the drive between receiving the command input and setting the command acknowledgment.

Operating Modes

Operating modes define which command values will be processed in which format, leading to the desired drive motion. They do not define how these command values will be transmitted from a control system to the drive.

One of the four selectable operating modes (S-0-0032…S-0-0035) is active when:

- the control and power supply is ready for operation and the controller enable signal is positive.
- The drive displays **"AF"** in the H1 display.

Note: All implemented operating modes are stored in parameter S-0-0292, List of all operation modes.

See also: "Operating modes"

Warnings

Warnings do not cause automatic shutdowns

Many areas are monitored in connection with operating modes and parameter settings. A warning will be generated if a state is detected that allows proper operation for the time being, but will eventually generate an error and thereby lead to a shutdown of the drive if this state continues.

Warning Classes

The warning class is evident from the diagnostic message

Warnings can be separated into 2 classes. They are differentiated by whether the drive executes an automatic reaction when the warning appears.

Warning Class:	Diagnostic Message:	Drive Response:
With drive response	E8xx	reacts on its own specifically in terms of any occurring warnings
Without drive response	E2xx	--

Fig. 3-6: Breakdown of the Warning Classes

Note: Warnings cannot be cleared externally.They pend until the conditions that lead to the warning are no longer present.

Error

Many areas are monitored in connection with operating modes and parameter settings. An error message is generated if a condition is encountered which no longer allows proper operation

Error Classes

The error class is evident from the diagnostic message.

Errors are separated into four different drive's error response:

Error Class:	Diagnostic Message:	Drive Response:
Fatal	F8xx	Torque free switching
Travel range	F6xx	Velocity command value switched to zero
Interface	F4xx	In accordance with best possible deceleration
Non-fatal	F2xx	In accordance with best possible deceleration

Fig. 3-7: Error class divisions

Drive's Error Response

If an error state is detected in the drive, the drive's error response will automatically be executed as long as the drive is in control. The H1 display flashes Fx / xx. The drive's reaction to interface and non-fatal errors can be parameterized with **P-0-0119, Best possible deceleration**. The drive switches to torque-free operation at the end of each error reaction.

Clearing Errors

Errors must be externally cleared.

Errors are not automatically cleared; they are cleared externally by:

- Initiating the command **S-0-0099, C500 Reset class 1 diagnostic or**
- Pressing the **"S1"** key.

If the error state is still present, then the error will be immediately detected again.

Clearing Errors When Controller Enable Is Set

If an error is discovered while operating with set controller enable, the drive will execute an error response. The drive automatically deactivates itself at the end of each error response; in other words, the power stage is switched off and the drive switches from an energized to a de-energized state.

To reactivate the drive:

- clear the error
- enter a 0-1 edge bit into the controller enable

Note: In fielbus drives the state machine must first be initialised .

Error memory

Error memory and operating hour counter

Once errors are cleared, they are stored in an error memory. The last 19 errors are stored there and the times they occurred.

Errors caused by a shutdown of the control voltage (e.g., **F870 +24Volt DC error**) are not stored in the error memory.

operating hour

Simultaneously, there is an operating hour counter for control and power sections of the drive controller. This function has the following parameters:

- **P-0-0190, Operating hours control section**
- **P-0-0191, Operating hours power section**
- **P-0-0192, Error recorder diagnosis number**
- **P-0-0193, Error recorder, operating hours control section**

IDN List of Parameters

There are parameters in the drive that, in turn, contain ID numbers of drive parameters. These support the handling of the drive parameters with parametrization programs (e.g., Drivetop, Serctop, and so on).

S-0-0017, IDN-list of all operation data

The ID numbers of all parameters in the drive are in this parameter. This list supports, for example, the parametrization program in the menu of which "All drive parameters" the information as to which ID number is in this drive firmware is stored.

S-0-0192, IDN-list of backup operation data

In parameter **S-0-0192, IDN-list of backup operation data** the ID numbers of all those parameters are stored, that are stored in the programming module. These are the parameters that are needed for a proper operation of the drive. The control or the parametrization program uses this ID number list to secure a copy of the drive parameters.

S-0-0021, IDN-list of invalid op. data for comm. Ph. 2

In the data of these ID lists, the drive enters the ID numbers out of parameter **S-0-0018, IDN-list of operation data for CP2** which are recognized as invalid in command **S-0-0127, C100 Communication phase 3 transition check**. Parameters are recognized as invalid if:

- their checksums, that are stored together with the operating data in a non-resident memory (programming module, amplifier or motor feedback data memory), do not fit to the operating data,
- their operating data is outside of the minimum/maximum input range or
- their operating data has violated the plausibility rules.

In any event, the parameters entered upon negative acknowledgement of command **S-0-0127, C100 Communication phase 3 transition check** in **S-0-0021, IDN-list of invalid op. data for comm. Ph. 2** must be corrected.

S-0-0022, IDN-list of invalid op. data for comm. Ph. 3

The drive enters the ID numbers out of parameter **S-0-0019, IDN-list of operation data for CP3** into the data of this ID list, which were detected in command **S-0-0128, C200 Communication phase 4 transition check** as invalid. Parameters are detected as invalid if:

- their checksum, stored together with the operating data in a non-resident memory (programming module, amplifier or motor feedback data memory) do not match the operating data,
- their operating data are outside of the minimum/maximum input limits or
- their operating data has violated the plausibility rules.

In any event, the parameters entered upon negative acknowledgement of command **S-0-0128, C100 Communication phase 4 transition check** in **S-0-0022, IDN-list of invalid op. data for comm. Ph. 3** must be corrected..

S-0-0018, IDN-list of operation data for CP2

The ID numbers that were checked for validity in command **S-0-0127, C100 Communication phase 3 transition check** are stored in **S-0-0018, IDN-list of operation data for CP2**.

S-0-0019, IDN-list of operation data for CP3

The ID numbers that were checked for validity in command **S-0-0128, C200 Communication phase 4 transition check** are stored in **S-0-0019, IDN-list of operation data for CP3**.

S-0-0025, IDN-list of all procedure commands

The ID numbers of all the commands in the drive are stored in this parameter.

3.2 Parametrization Mode - Operating Mode

Note: A drive controller with fieldbus interface immediately switches into operating mode when switched on.

The switch from parametrization to operating mode is controlled by start and end commands

- **S-0-0127, C100 Communication phase 3 transition check**
- **S-0-0128, C200 Communication phase 4 transition check**
- **P-0-4023, C400 Communication phase 2 transition**

It is necessary to trigger the transition command **P-0-4023, C400 Communication phase 2 transition** to get into parametrization mode.

Note: In order to be able to switch between parametrization mode and Operating mode, it is only possible to start a transition command, if the drive is not in control mode or command communications is not active.

The current status of command communications is in parameter **P-0-4086, Command communication status**.

If the drive reaches phase 4 without an error, then the message (H1) "**bb**" appears on the 7-segment display on the front of the drive amplifier. The corresponding diagnosis is: **A013 Ready for power on**

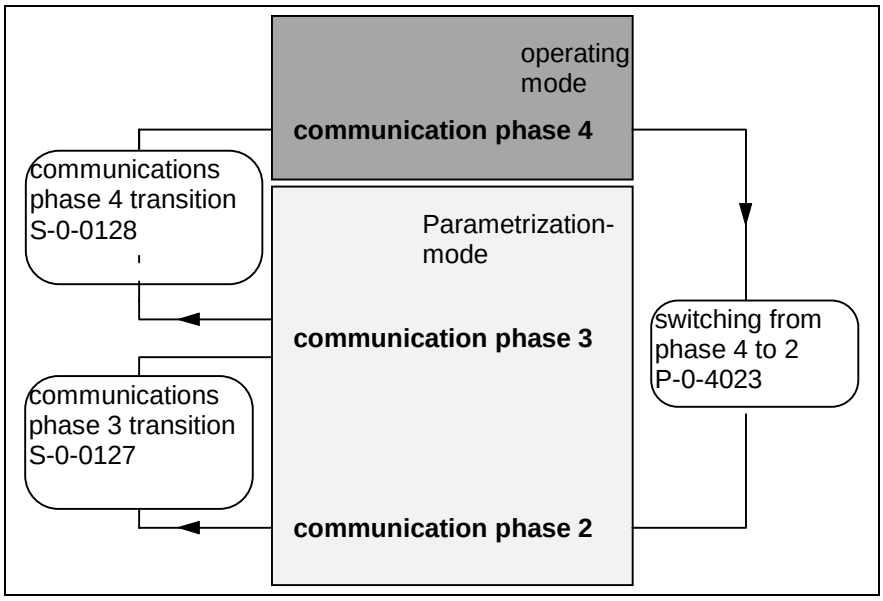


Fig. 3-8: The communications phases

Note: The evaluation of the measuring systems as well as the processing of the encoder emulations only takes place in operating mode. Switching from operating mode into parametrization mode means that these functions are no longer active. The switch into operating mode always starts a new initialization of all the functions within the drive.

Checks in the Transition Commands

To switch from communication phases 2 to 3 and 3 to 4, it is necessary to activate transition checks in the drive first. This includes a number of checks and parameter conversions.

Note: The reasons for and assistance with transition command errors are specified in the diagnostics description.

S-0-0127, C100 Communication phase 3 transition check

The timing of command communications is checked in transition command C1. These checks are irrelevant for those units without command communications. (Examples of command communications are SERCOS, Profibus and so on.)

The following checks are conducted in the C1 command.

Checking the telegram configuration of the command communications

This checks as to whether the parameters selected for the configurable data block in the master data telegram or drive data telegram may be configured or not. It also checks whether the allowable length of the configurable data blocks has been retained or not.

The following command errors can occur, in this case: :

- **C104 Config. IDN for MDT not configurable**
- **C105 Configurated length > max. length for MDT**
- **C106 Config. IDN for AT not configurable**
- **C107 Configurated length > max. length for AT**

Checking validity of communications parameters

If a parameter needed for transition to phase 3 has never been written into or the backup is faulty, then command error

- **C101 Invalid communication parameter (S-0-0021)**

is generated. The ID no. of the faulty parameters are listed in:

- **S-0-0021, IDN-list of invalid op. data for comm. Ph. 2**

They are made valid by writing into them.

Extreme value check of the communications parameters

If an error occurs during the extreme value check of those parameters relevant to the command communications, then command error

- **C102 Limit error communication parameter (S-0-0021)**

is generated. The ID numbers of the faulty parameters are listed in

- **S-0-0021, IDN-list of invalid op. data for comm. Ph. 2**

and must then be corrected.

Checking plausibility and maintaining the marginal conditions for command communications

Checking the timing parameters for command communications in terms of plausibility and maintaining marginal conditions.

The following command errors can occur:

- **C112 TNcyc (S-0-0001) or TScyc (S-0-0002) error**
- **C113 Relation TNcyc (S-0-0001) to TScyc (S-0-0002) error**
- **C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)**

S-0-0128, C200 Communication phase 4 transition check

During this command, the following checks are run.

Checking P-0-4014 for plausibility

If in parameter **P-0-4014, Motor type** 1 (MHD) or 5 (MKD/MKE) are selected and the motor feedback data memory has not found that type, then command error

- **C204 Motor type P-0-4014 incorrect**

is generated.

Checking validity

If a parameter needed for transition to phase 4 has never been written into, and its backup is faulty, then command error

- **C201 Invalid parameter(s) (->S-0-0022)**

is generated. The ID number of the faulty parameters are listed in

- **S-0-0022, IDN list of invalid op. data for comm. Ph. 3**

and are made valid by writing into.

Reading the controller memory

The drive controller reads the non-volatile memory, e.g., EEPROM, of the drive controller operating data. If an error occurs during this process, then command error:

- **C212 Invalid amplifier data (->S-0-0022)** appears**.**

The ID number of the faulty parameter is written in

- **S-0-0022, IDN-list of invalid op. data for comm. Ph. 3.**

Checking whether optional encoder is needed

If operating mode parameters **S-0-0032..35** or referencing parameter **S-0-0147** bit3 dictates that a second encoder is required but a "0" is entered in parameter **P-0-0075, Feedback type 2** then the faulty parameter(s) is listed in:

- **S-0-0022, IDN-list of invalid op. data for comm. Ph. 3**

Command error

- **C210 Feedback 2 required (->S-0-0022)** appears.

Checking whether motor encoder is availablet

Check whether a motor encoder is available (**P-0-0074, Feedback type 1** = 0) and no "2" is entered in function parameter **P-0-0185, Function of encoder 2** for load-side motor encoder. If this is the case, then command error

- **C236 Feedback 1 required (P-0-0074)**

is generated.

Checking motor encoder settings

If the encoder parametrized in parameter **P-0-0074, Feedback type 1** is not available, or its data cannot be read, then this error message is generated

- **C217 Feedback1 data reading error**

Checking optional encoder settings

If the encoder interface selected in parameter **P-0-0075, Feedback type 2** is already occupied by the motor encoder, then this error message is generated:

- **C234 Encoder combination not possible**

generated.

If a second encoder with feedback data memory is used but its data cannot be read, then error message

- **C218 error when reading data of encoder 2**

is generated. If parameter **P-0-0185, Funktion Encoder 2** "load-side motor encoder" is selected, but there is no rotary asynchronous motor, then error message

- **C235 Load-side motor encoder only with asynchronous motor**

is generated.

Reading out feedback data memory

The parameters stored in the memory of motors with feedback data memory are read. If an error occurs during this process, then command error

- **C211 Invalid feedback data (->S-0-0022)** is generated.

Checking maximum travel range

Check whether an internal position resolution has been set via parameter **S-0-0278, Maximum travel range** which guarantees the correct commutation of the motor. If not, then this command error appears:

- **C223 Input value for max. range too high.**

Checking scaling

Check internal ability to illustrate conversion factors from display format to an internal one and vice versa for scaling-dependent data.

If an error occurs, then one of the following command errors can be generated:

- **C213 Position data scaling error**
- **C214 Velocity data scaling error**

- **C215 Acceleration data scaling error**
- **C216 Torque/force data scaling error**

Checking all parameters for extreme values and possible bit combinations

All parameters are checked for maintaining extreme values or permissible bit combinations. If an error occurs, then command error

- **C202 Parameter limit error (->S-0-0022)**

is generated. The ID number of the faulty parameter is listed in

- **S-0-0022, IDN-list of invalid op. data for comm. Ph. 3**

and must be corrected.

Checking modulo range

Checking whether an activated modulo scaling of the position from parameter **S-0-0103, Modulo value** is possible. If it is not, then command error

- **C227 Modulo range error**

is generated.

Checking the conversion of internal formats

The physical values of parameters (input format with decimal places and units) are converted to internal formats. This conversion is monitored. If incongruencies are detected during this process, then command error

- **C203 Parameter calculation error (->S-0-0022)**

is generated. The ID number of the faulty parameter is listed in

- **S-0-0022, IDN-list of invalid op. data for comm. Ph. 3**

and must be corrected.

Checking encoder initialization

Encoder initialization is listed. Errors can occur depending on encoder type (e.g., index length wrong in DSF feedback). Then one of the following command error

- **C220 Feedback 1 initializing error**
- **C221 Feedback 2 initializing error**

is generated.

Checking controller type

Depending on controller type, various internal settings are performed. If parameter **S-0-0140, Controller type** cannot be read, then command error

- **C228 Controller type S-0-0140 wrong**

is generated.

Absolute encoder montioring

If the actual position of an absolute encoder is outside of the range of the current actual position prior to the last shutdown of the unit +/- **P-0-0097, Absolute encoder monitoring window,** then error

- **F276 Absolute encoder outside of monitoring window**

is generated. The acknoweldgement of the transition command is not faulty in this case but rather the error must be cleared by executing command **S-0-0099, C500 Reset class 1 diagnostics**.

(see also chapter: "Clearing error").

3.3 Commissioning Guidelines

For commissioning drive controllers, the parametrization interface DRIVETOP can be used.

The procedures for commissioning a drive controller entail 11 steps (IBS-1..11). The sequence is illustrated below.

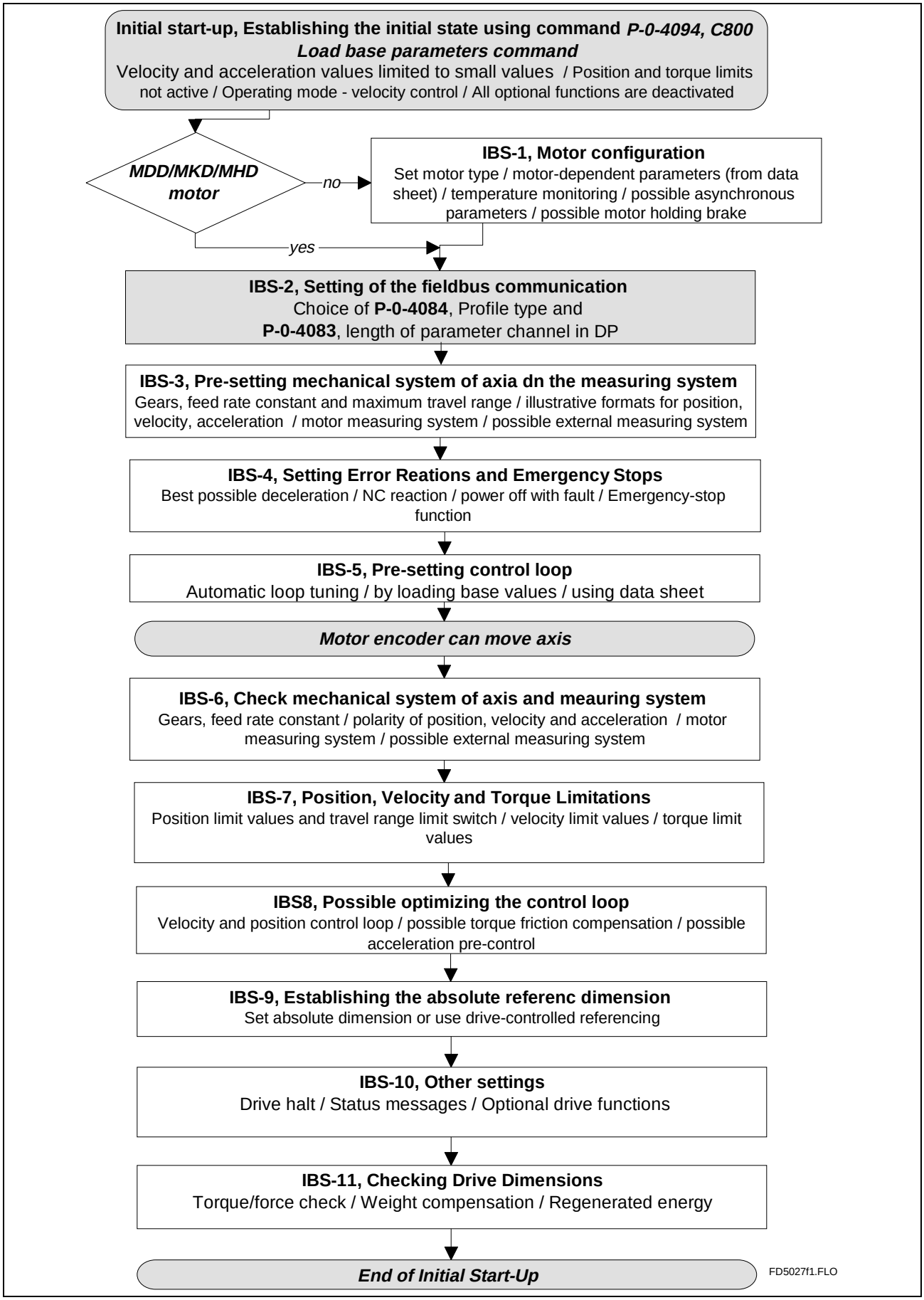

Initial start-up, Establishing the initial state using command P-0-4094, C800
Load base parameters command
Velocity and acceleration values limited to small values / Position and torque limits not active / Operating mode - velocity control / All optional functions are deactivated
MDD/MKD/MHD motor
no
IBS-1, Motor configuration
Set motor type / motor-dependent parameters (from data sheet) / temperature monitoring / possible asynchronous parameters / possible motor holding brake
yes
IBS-2, Setting of the fieldbus communication
Choice of P-0-4084, Profile type and
P-0-4083, length of parameter channel in DP
IBS-3, Pre-setting mechanical system of axia dn the measuring system
Gears, feed rate constant and maximum travel range / illustrative formats for position, velocity, acceleration / motor measuring system / possible external measuring system
IBS-4, Setting Error Reations and Emergency Stops
Best possible deceleration / NC reaction / power off with fault / Emergency-stop function
IBS-5, Pre-setting control loop
Automatic loop tuning / by loading base values / using data sheet
Motor encoder can move axis
IBS-6, Check mechanical system of axis and meauring system
Gears, feed rate constant / polarity of position, velocity and acceleration / motor measuring system / possible external measuring system
IBS-7, Position, Velocity and Torque Limitations
Position limit values and travel range limit switch / velocity limit values / torque limit values
IBS8, Possible optimizing the control loop
Velocity and position control loop / possible torque friction compensation / possible acceleration pre-control
IBS-9, Establishing the absolute referenc dimension
Set absolute dimension or use drive-controlled referencing
IBS-10, Other settings
Drive halt / Status messages / Optional drive functions
IBS-11, Checking Drive Dimensions
Torque/force check / Weight compensation / Regenerated energy
End of Initial Start-Up
FD5027f1.FLO

Fig. 3-9:Commissioning guidelines

IBS-1, Motor configuration

motor without data memory

These guidelines are needed in the case where the motor used does not have a motor feedback memory. It is necessary with these motors

- to enter the parameters for motor features (peak current, maximum velocity, etc.) using the data sheet or with DRIVETOP using data from the motor data bank.
- The parameters for the motor temperature warning and off thresholds must be parametrized as well
- and giving a motor holding brake, these must be properly set also.

motor with data memory

Those motors with data memory such as

- MHD and
- MKD motors

are recognized by the drive and motor parameters are automatically set.

(See also chapter: "Setting the motor type“.)

IBS-2, Setting up fieldbus communication

P-0-4084, Profile type must be set up in this step to be able to select the operating mode wanted and its relevant profile interpreter (including status machine).

To ensure the functioning of the related modes (S-0-0032 to S-0-0035), the following is necessary:

- operating mode-specific settings (e.g., positioning block data in positioning block mode)
- mode-relevant limit value settings
- command value filter settings that may be necessary
- definition of the operating modes available.

Note: In the case of command communications using a Profibus it is also possible in this step to define a parameter channel in the real time channel **P-0-4083, Length of parameter channel**. For CANbus it is necessary to also set the **P-0-4079, Fieldbus baudrate** here.

(See also chapter :: "Operating mode select codes".)

IBS-3, Presetting the axis mechanics and measuring systems

In this step, the parameters needed for determining and processing position, velocity and acceleration data are set. These include the following parameters for the following settings:

- mechanical gear ratio between motor and load as well as any existing feedrate constants of the drive of linear slides
- scaling settings for showing position, velocity and acceleration parameters of the drive. This sets, for example, whether the data is motor shaft or load related and which LSB valence these have, e.g., position data with 0.001 degrees or 0.0001 inches and so on.
- Interfaces, rotational directions and the resoluton of the motor encoder, and where available, optional encoders.

(See also chapter : -"Physical Values Display Format"
-"Mechanical Transmission Elements" and
-"Setting the Measurement System").

IBS-4, Setting the error reactions and E-stop

In this step, the reaction of the drive in the event of an error is set as well as the triggering of the drive's own E-stop input. The following parametrizations must be performed:

- type and mode of error reactions in drive
- selection whether NC reaction in error case should happen
- selection whether and when the power supply is switched off and whether a package reaction is to be conducted
- Configuration of the E-stop input

(See also chapter: "Drive Error Reaction“)

IBS-5, Pre-setting Control Loop

The parameters for current, velocity and position control loops are set in this step. This is done either by:

- Execute command **P-0-0162, D900 Command Automatic control loop adjust**. During the execution of the command, the setting for the velocity controller and the position controller is determined as well as the load inertia.
- Execute command **S-0-0262, C700 Command basic load** or
- by inputting the controller values specified in the data sheet.

Setting the control loop in this way makes ensures a good level of quality for most applications. Should additional optimization of the control loop parameters become necessary (velocity and position control loop parameters, compensation functions and precontrol), then use commissioning step no. 8.

(See also chapter: "Control loop settings".)

IBS-6, Checking axis mechanics and measuring system

The presettings made in IBS 2 are checked here and modified, if necessary. This means that the axis must be moved by jogging. The following checks must be made:

- check the rotational direction of the motor encoder. With non-inverted position polaritiy (**S-0-0055, Position polarities** = 0), the values in parameter **S-0-0051, Position feedback 1 value** should have a rising order with a clockwise rotation of the motor. (This check need not be performed in MDD and MKD motors. If this is not the case, then bit 2 in **S-0-0277, Position feedback 1 type** must be inverted.
- By moving the axes and examining the position feedback value of the motor encoder in parameter **S-0-0051, Position feedback 1 value** it can be controlled whether a distance in this process is correctly displayed. If not, then the settings for mechanical gear ratio, feedrate constants and encoder resolution must be checked.
- Given a second encoder, by moving the axis and examining the position feedback value of the external encoder in parameter **S-0-0053, Position feedback 2 value** it can be checked whether a distance is correctly displayed with this process. **S-0-0051, Position feedback 1 value** and **S-0-0053, Position feedback 2 value** should run parallel when jogging a specific path. If not, then check the settings in **P-0-0075, Feedback type 2, S-0-0117, Feedback 2 Resolution, S-0-0115, Position feedback 2 type** and **P-0-0185, Function of encoder 2.**

(See also chapter : -"Physical Values Display Format"
-"Mechanical Transmission Elements" and
-"Setting the Measurement System").

IBS-7, Limits for position, velocity and torque

The limits for the travel range are conducted by setting

- position limits values and/or
- travel range limit switches

as well as the limit values for the axis velocity and maximum drive torque/force are parametrized also.

(See also chapter: -"Torque/force limiting",
-"Travel range limits" and
-"Limiting velocity".)

IBS-8, Optimizing the control loop

This step is only necessary if the settings for velocity and position control loops in IBS 4 did not achieve the needed quality. As such, optimize the control behavior as follows:

- modify the parameter for velocity and position control loops
- possibly activate the acceleration pre-control
- possibly activate the velocity mixture and
- possibly activate the notch filter.

(See also chapter: "Control loop settings“.)

IBS-9, Establishing absolute reference measuring

Here the absolute reference measuring is set in terms of the machine zero point of the position feedback value from motor encoder and possibly optional encoder. The position feedback values at first show any, not machine zero point related values. By conducting

- setting absolute measuring (with absolute encoders) or
- drive-controlled homing

the coordinate systems of the position encoder and the coordinate system of the machine are made congruent.

(See also chapter: -"Drive-controlled homing" and
-"Set Absolute Measuring")

IBS-10, Other settings

Here

- drive halt function is parametrized,
- the language selected,
- general status message settings and
- the optional drive function settings are conducted.

(See also chapter: -"Drive Halt"
-"S-0-0013, Class 3 diagnostics"
-"S-0-0182, Manufacturer class 3 diagnostics"
-"Optional Drive Functions"
-"Language Selection"

IBS-11,Controlling drive dimensions

The power-related drive checks are conducted here. It is checked whether the continuous and peak power of drive amplifier and motor meet the requirements. The following checks are conducted for this purpose:

- generated torque/force of motor is checked. At a constant speed 60% and in rapid traverse 75% of the continuous torque at standstill of the motor should not be exceeded
- during the acceleration phase 80% of the maximum torque of the motor/controller combination may not be exceeded
- the thermal load of the drive amplifier should equal a maximum of 80%

(See also chapter: "Current Limit")

With vertical axis, the weight compensation must be set so that the current consumption with upwards and downwards motions of the axes have the same minimum value.

Check the regenerated peak power and regenerated continuous power.

3.4 Diagnostic Configurations

Overview of Diagnostic Configurations

The diagnostics are configured into 2 groups:

- options for recognizing the current operating states of the priority-dependent, drive-internal generation of diagnoses
- collective messages for diverse status messages

Additionally, there are parameters for all important operating data that can be transmitted both via the command communications (SERCOS, Profibus, ...) as well as the parametrization interface (RS-232/485 in the ASCII protocol or SIS serial Indramat protocol).

Drive-Internal Diagnostics

The current operating condition of the drive is evident by which errors, warnings, commands and drive stop signals are available and which operating mode is active. Whether the drive is in preparation for operation or in parameter mode also is displayed.

The current operating condition can be determined from

- the 2-part seven-segment display (H1 display)
- the diagnostic parameter **S-0-0095, Diagnostic Message**
- the parameter **S-0-0390, Diagnostic Message Number**
- the parameter **P-0-0009, Error Message Number**
- the parameter **S-0-0375, List of diagnostic numbers**

Note: A profile-dependent status machine has been implemented in some fieldbus drives. See also chapter: "Profile types".

The current diagnostic message with the highest priority is always shown in the

- H1 display,
- **S-0-0095, Diagnostic Message** and
- **S-0-0390, Diagnostic Message Number**.

The parameter **P-0-0009, Error Message Number** will contain a value unequal to 0 if an error is present.

The last displayed diagnostic numbers are displayed in chronological order in parameter **S-0-0375, List of diagnostic numbers**.

An overview of all diagnostic messages can be found in the diagnostic message description (Troubleshooting Guide).

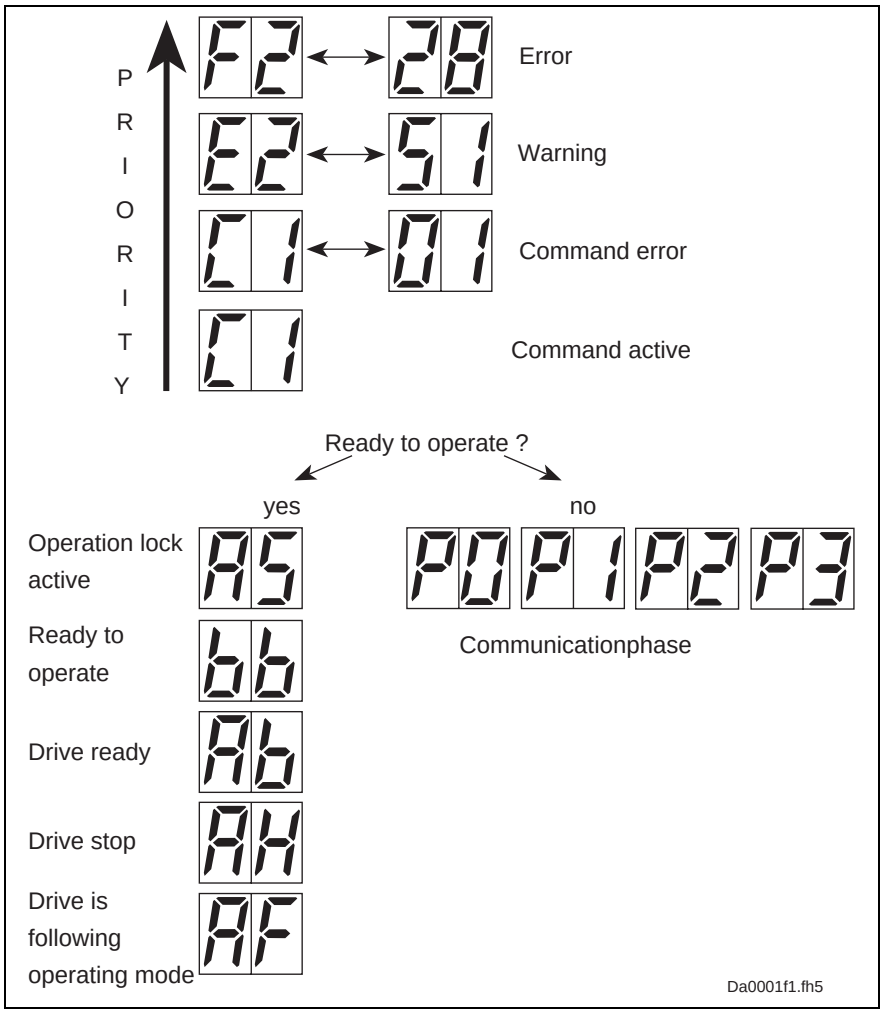


Fig. 3-10: Priority-dependent diagnostic formation on the H1 display

Diagnostic Message Composition

Each operating condition is designated with a diagnostic message, which consists of a

- diagnostic message number and a
- diagnostic text

For example, the diagnostic message for the non-fatal error "Excessive Control Deviation" is displayed as follows.

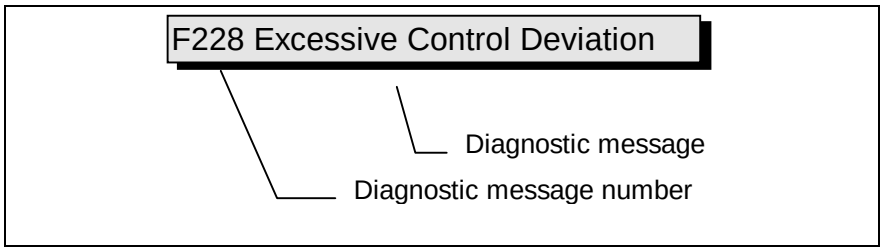


Fig. 3-11: Diagnostic message composition with a diagnostic message number and text

The H1 display alternates "F2" and "28". The diagnostic message number appears in hexadecimal format in the parameter **S-0-0390, Diagnostic Message Number**. In this example, this would be (0x)F228. The diagnostic message number and the diagnostic text are contained as a string "**F228 Excessive deviation**" in the parameter **S-0-0095, Diagnostic Message**.

H1-Display

The diagnostic number appears on the two-part seven-segment display. The form of the display emerges from the graphic "Priority-Dependent Display of the Diagnostic Message".

With the help of this display, it is possible to quickly determine the current operating status without using a communication interface.

The operating mode cannot be seen on the H1-Display.

If the drive follows the operating mode and no command was activated, then the symbol "AF" appears on the display.

Note: A superposed status machine is possible with command communications via a fieldbus.

Diagnostic Message

The diagnostic message contains the diagnostic number followed by the diagnostic text, as shown in the example, "Excessive Control Deviation." It can be read with the parameter **S-0-0095, Diagnostic Message** and directly displays the operation status on an operator interface.

The diagnostic message language can be changed.

Diagnostic Message Number

The diagnostic message number contains only the diagnostic number without the text. It can be read with the parameter **S-0-0390, Diagnostic Message Number**.

Error Number

The error number contains only the error number without the diagnostic text. It can be read with the parameter **P-0-0009, Error Message Number** and can indicate an error condition without a language barrier. This parameter contains a value unequal to "0" if an error is present in the drive.

An error is formed from the bottom 3 digits of the diagnostic number. For example, the error "**F228 Excessive deviation**" with the diagnostic message number "(0x)F228" would produce the error number "228."

List of diagnostic numbers

The 50 previously displayed diagnostic numbers are displayed in chronological order in parameter **S-0-0375, List of diagnostic numbers**. Every change in contents of **S-0-0390, Diagnostic message number** means that the old contents are transfered into **S-0-0375, List of diagnostic numbers**. If **S-0-0375, List of diagnostic numbers** is read, then the last replaced diagnostic number appears in the first element; the diagnostic number displayed penultimately is displayed in the second element and so on.

The following illustrated explains the relationship between **S-0-0375, List of diagnostic numbers** and **S-0-0390. Diagnostic message number** with the use of an example.

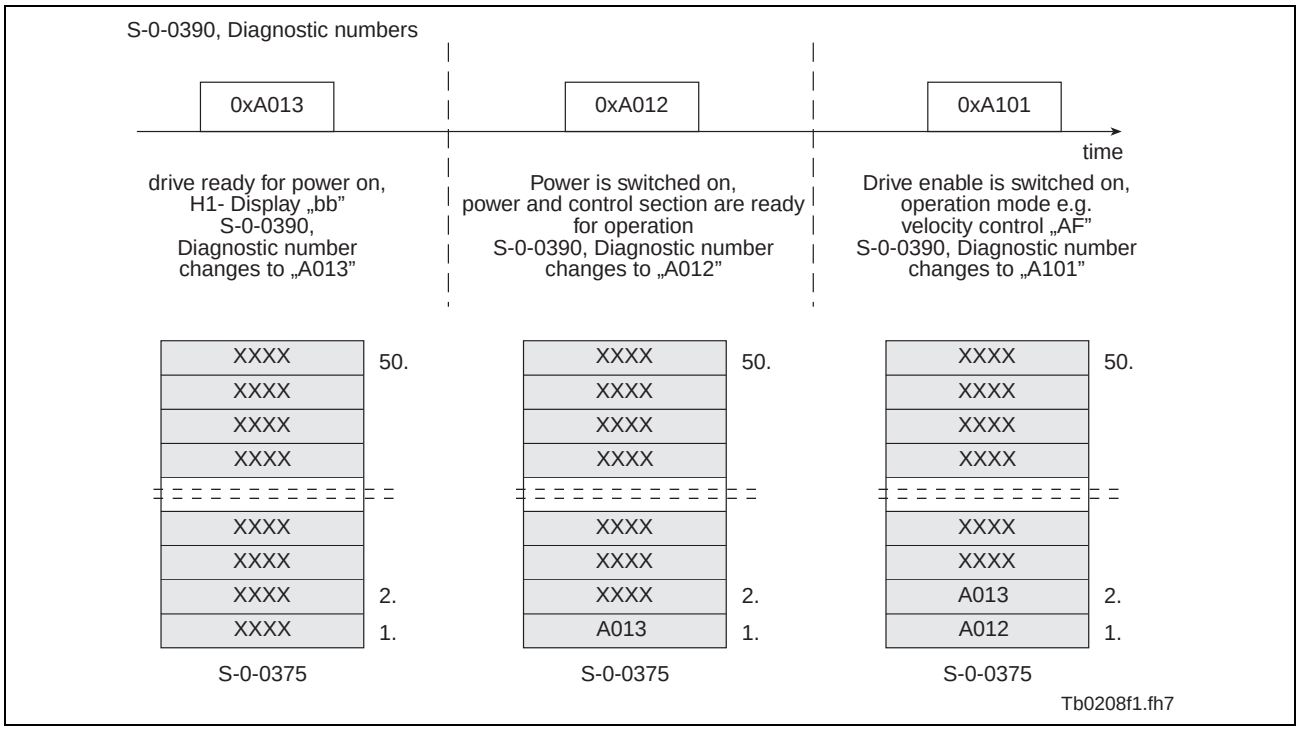

S-0-0390, Diagnostic numbers
0xA013
0xA012
0xA101
time
drive ready for power on, H1- Display „bb” S-0-0390, Diagnostic number changes to „A013”
Power is switched on, power and control section are ready for operation S-0-0390, Diagnostic number changes to „A012”
Drive enable is switched on, operation mode e.g. velocity control „AF” S-0-0390, Diagnostic number changes to „A101”
XXXX
50.
2.
1.
A013
A012
S-0-0375
Tb0208f1.fh7

Fig. 3-12: Example for generating **S-0-0375, List of diagnostic numbers**

Permanently-Configured Collective Indication

There are parameters that represent a collective indication for the display of operating states. These are individually listed

- **S-0-0011, Class 1 diagnostics**
- **S-0-0012, Class 2 diagnostics**
- **S-0-0013, Class 3 diagnostics**
- **S-0-0182, Manufacturer class 3 diagnostics**

S-0-0011, Class 1 diagnostics

In parameter **S-0-0011, Class 1 diagnostics** there are bits for the various errors. A bit is set in this parameter in the event of a drive error. Simultaneously, bit 13 "Drive lock, error in class 1 diagnostics" is set in the **S-0-0135, drive status word.**

All bits in class 1 diagnostics, are cleared upon execution of the command **S-0-0099, C500 Reset class 1 diagnostic**.

(See chapter: clear error)

The following bits are supported in status class 1.

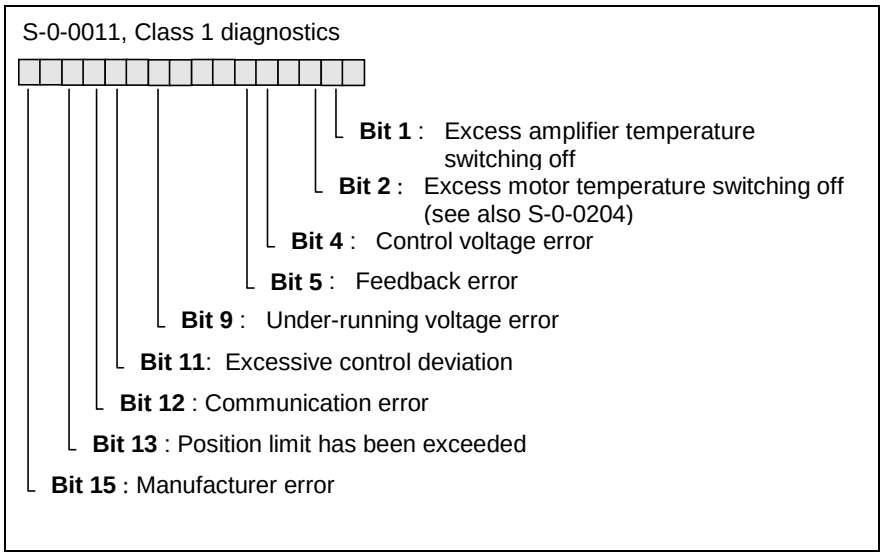

S-0-0011, Class 1 diagnostics
Bit 1 : Excess amplifier temperature switching off
Bit 2 : Excess motor temperature switching off (see also S-0-0204)
Bit 4 : Control voltage error
Bit 5 : Feedback error
Bit 9 : Under-running voltage error
Bit 11: Excessive control deviation
Bit 12 : Communication error
Bit 13 : Position limit has been exceeded
Bit 15 : Manufacturer error

Fig. 3-13: S-0-0011, Class 1 diagnostics

Note: In case of an error the output error bit (X3, Pin 8) will be set.

S-0-0012, Class 2 diagnostics

Warnings

There are bits for various warnings in this parameter. In the event of a warning, a bit is set in this parameter. Simultaneously, bit 12 "Change bit class 2 diagnotics" is set in the **S-0-0135, drive status word.** Via parameter **S-0-0097, Mask class 2 diagnostic** warnings can be masked in terms of their effect on the change bit.

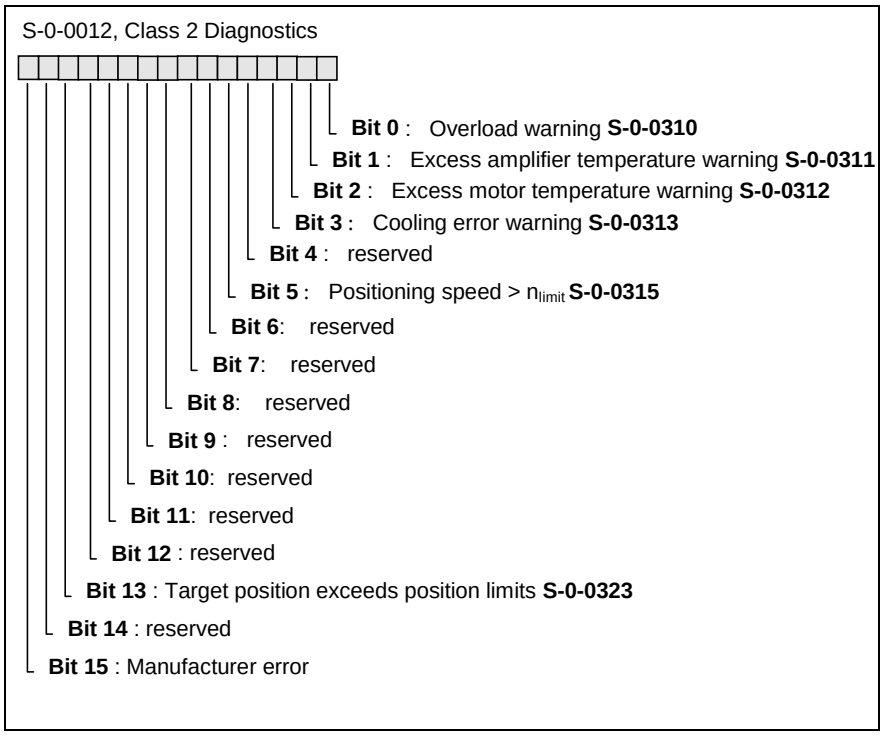

S-0-0012, Class 2 Diagnostics
Bit 0 : Overload warning S-0-0310
Bit 1 : Excess amplifier temperature warning S-0-0311
Bit 2 : Excess motor temperature warning S-0-0312
Bit 3 : Cooling error warning S-0-0313
Bit 4 : reserved
Bit 5 : Positioning speed > n_{limit} S-0-0315
Bit 6: reserved
Bit 7: reserved
Bit 8: reserved
Bit 9 : reserved
Bit 10: reserved
Bit 11: reserved
Bit 12 : reserved
Bit 13 : Target position exceeds position limits S-0-0323
Bit 14 : reserved
Bit 15 : Manufacturer error

Fig. 3-14: Structure of parameter S-0-0012, Class 2 diagnostics

Note: In case of a warning the output warning bit (X3, pin 10) will also be set.

S-0-0013, Class 3 diagnostics

Various messages about operating states are stored here . If the state of a message changes, then a bit is set here as well in **drive status word** ("Change bit class 3 diagnostics"). This change bit is cleared again by reading **S-0-0013, Class 3 diagnostics.** Via parameter **S-0-0098, Mask class 3 diagnostic** warnings can be masked in terms of their effect on the change bit.

The following bits are supported in class 3 diagnostics.

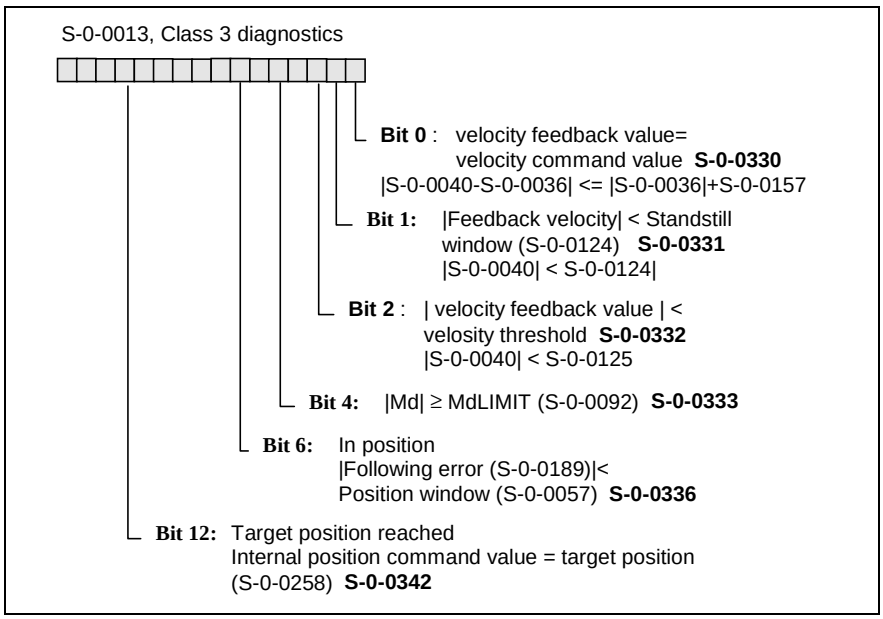

S-0-0013, Class 3 diagnostics
Bit 0 : velocity feedback value= velocity command value S-0-0330
|S-0-0040-S-0-0036| <= |S-0-0036|+S-0-0157
Bit 1: |Feedback velocity| < Standstill window (S-0-0124) S-0-0331
|S-0-0040| < S-0-0124|
Bit 2 : | velocity feedback value | < velosity threshold S-0-0332
|S-0-0040| < S-0-0125
Bit 4: |Md| ≥ MdLIMIT (S-0-0092) S-0-0333
Bit 6: In position
|Following error (S-0-0189)|<
Position window (S-0-0057) S-0-0336
Bit 12: Target position reached
Internal position command value = target position
(S-0-0258) S-0-0342

Fig. 3-15: Structure of S-0-0013, Class 3 diagnostics

S-0-0182, Manufacturer class 3 diagnostics

In parameter **S-0-0182, Manufacturer class 3 diagnostics** various messages about the operating states are stored there as well. If the state of a message changes, then this is not signaled with a change bit.

The following bits are supported in manufacturer's class 3 diagnostics.

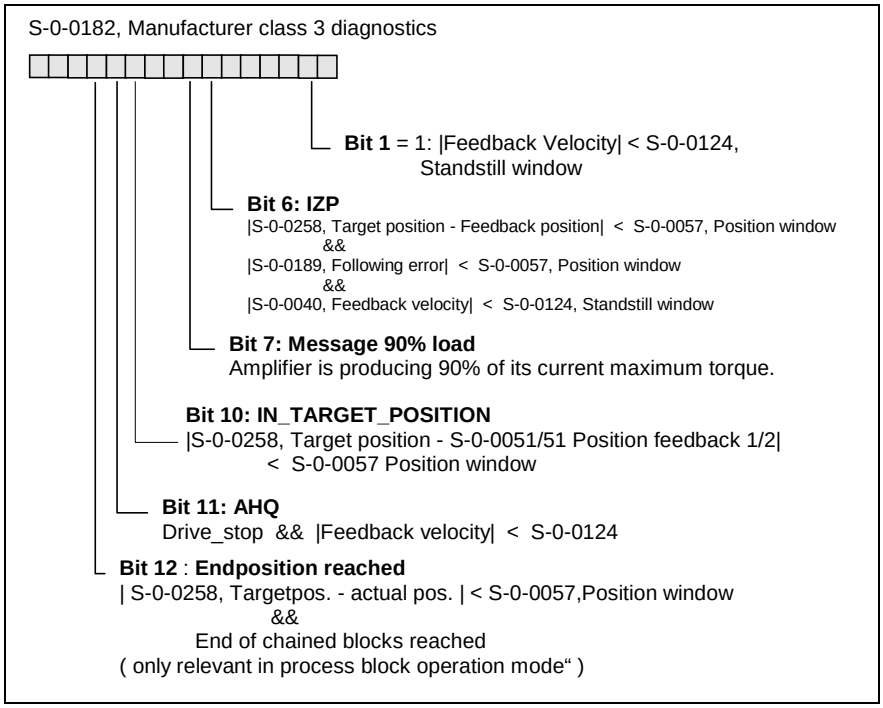

S-0-0182, Manufacturer class 3 diagnostics
Bit 1 = 1: |Feedback Velocity| < S-0-0124, Standstill window
Bit 6: IZP
|S-0-0258, Target position - Feedback position| < S-0-0057, Position window
&&
|S-0-0189, Following error| < S-0-0057, Position window
&&
|S-0-0040, Feedback velocity| < S-0-0124, Standstill window
Bit 7: Message 90% load
Amplifier is producing 90% of its current maximum torque.
Bit 10: IN_TARGET_POSITION
|S-0-0258, Target position - S-0-0051/51 Position feedback 1/2|
< S-0-0057 Position window
Bit 11: AHQ
Drive_stop && |Feedback velocity| < S-0-0124
Bit 12 : Endposition reached
| S-0-0258, Targetpos. - actual pos. | < S-0-0057,Position window
&&
End of chained blocks reached
(only relevant in process block operation mode“)

Fig. 3-16: Structure of S-0-0182, Manufacturer class 3 diagnostics

3.5 Language Selection

With the parameter **S-0-0265, Language selection** you can switch between several languages for

- Parameter names and units
- Diagnostic texts

The following languages are implemented:

Value of S-0-0265:	Language:
0	German
1	English
2	French
3	Spanish
4	Italian

Fig. 3-17: Language Selection

3.6 Firmware Update with the Dolfi Program

With the help of the Dolfi program it has become possible to conduct firmware updates for a drive controler via the serial interface.

The program can be ordered from Indramat with item number:

-SWA-DOL*PC-INB-01VRS-MS-C1,44-COPY

or material number 279804.

This includes an extensive description of the program as well.

Error Message in the Firmware Loader

If a firmware update is conducted with a serial interface (using the SIS protocol), then the drive can generate error messages.

Dolfi and the display on the drive read as follows:

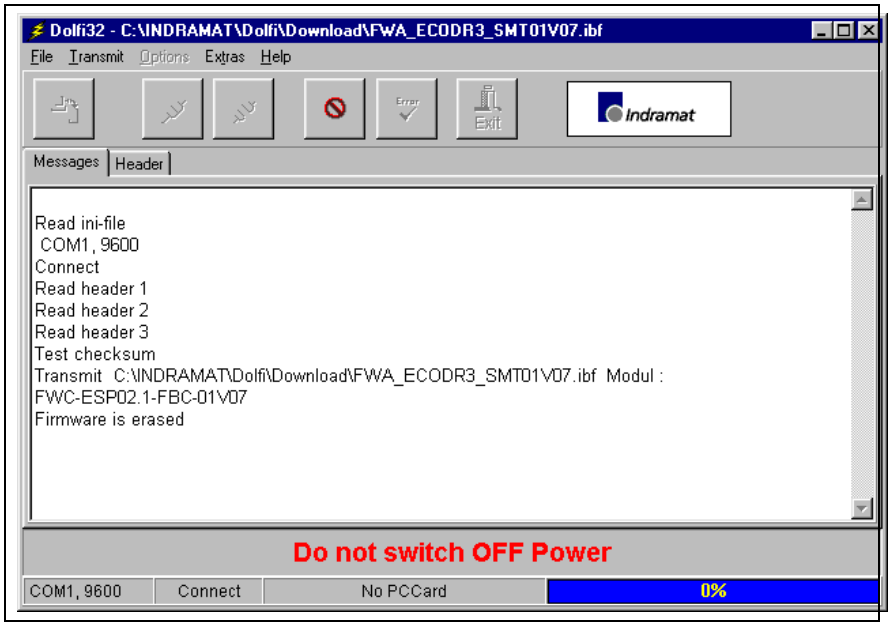


Fig. 3-18: Example: An illustration of how an error firmware was cleared

The table below lists the error messages:

SIS error message	7 segment display	Error message:
0x9002	dL / 00	Firmware was cleared
0x9003	-	Loading into phase 3 not allowed
0x9004	-	Loading into phase 4 not allowed
0x9102	dL / 03	Firmware was cleared
0x9103	-	Restart in phase 3 not allowed
0x9104	-	Restart in phase 4 not allowed
0x9200	dL / 06	Read error
0x9400	dL / 07	Timeout during reset
0x9402	dL / 0F	Address range not within flash storage
0x940A	dL / 08	Reset only in loader possible
0x960A	-	Programming only possible in loader
0x96E0	dL / 0b	Error during flash verification
0x96E1	dL / 0C	Timeout when programming flash
0x96FF	dL / 09	Error when writing into RAM
0x9701	dL / 0d	Addition checksum faulty
0x9702	dL / 0E	CRC32 checksum faulty

Fig. 3-19: SIS error of firmware loader

Note: While the firmware is being updated, the display of the drive reads "dL".

0x9002 (dL / 00) Firmware was cleared

Description: a) Programming the module FBC bootkernel or FIL firmware loader.

Firmware FIL is running, or the bootkernel must be replaced. To do so, the command "Drive firmware shutdown“ must be sent, i.e., the control must go from the FIL module to the FGP, SGP or SMT module. During the transition it is checked whether the checksum of the FGP, SGP or SMT is correct to ensure that the module was correctly programmed and can be called up. This checksum check went wrong.

b) Modules FGP, SGP or SMT must be programmed.

Firmware FGP, SGP or SMT must be replaced. To do so, the command "Shutdown, Loader“ must be sent. This means that the control must change from module FGP, SGP or SMT into module FIL: During the transition it is checked whether the addition checksum of the FIL module is correct or not to ensure that the module was correctly programmed and can be conducted. This checksum check went wrong.

Clearing the errors: On a)

Prior to programming the FIL it is necessary to program modules FGP, SGP or SMT.

On b)

Prior to programming FGP, SGP or SMT it is necessary to program FIL.

0x9003 Loading into phase 3 not allowed

Description: The drive is in phase 3. A change to the firmware loader is necessary because the firmware is to be replaced. This can only be done in phase 2.

Clearing errors: Switch the drive into phase 2.

0x9004 Loading into phase 4 not allowed

Description: The drive is in phase 4. A change to the firmware loader is necessary because the firmware is to be replaced. This can only be done in phase 2.

Clearing errors: Switch the drive into phase 2.

0x9102 (dL / 03) Firmware was cleared

Description: The drive firmware is to be restarted after the firmware was replaced. The programming of modules FGP, SGP or SMT was incomplete (addition checksum check went wrong).

Clearing errors: Modules FGP, SGP or SMT must be reprogrammed.

0x9103 Restart in phase 3 not allowed

Description: The drive is in phase 3 and the drive firmware must be restarted. This can only be done in phase 2.

Clearing errors: Switch the drive into phase 2.

0x9104 Restart in phase 4 not allowed

Description: The drive is in phase 4 and the drive firmware must be restarted. This can only be done in phase 2.

Clearing errors: Switch the drive into phase 2.

0x9200 (dL / 06) Read error

Description: A memory module is to be read. An error occurred while making the attempt.

Clearing errors: Check address range in the *.ibf file. If it is alright, i.e., a memory module is actually at that address, then the error can only be cleared by replacing the firmware module ESF02.1.

0x9400 (dL / 07) Timeout during reset

Description: An error occurred while trying to reset a flash.

Clearing errors: Repeat the reset command. If the error continues to appear, then it can only be cleared by replacing firmware module ESF02.1.

0x9402 (dL / 0F) Address range not in flash

Description: An address range not in the flash must be cleared.

Clearing errors: Correct address range in the SIS or check the range in the *.ibf file.

0x940A Reset only possible in loader

Description: Drive firmware is running and the flash is to be cleared.

Clearing errors: Change into firmware loader.

0x96E0 (dL / 0b) Error when verifying the flash

Description: An error occurred during the programming process. A memory cell in the flash could not be write accessed.

Clearing errors: The flash must be cleared prior to the programming command. If the error continues, then the firmware module ESF02.1 must be replaced.

0x96E1 (dL / 0C) Timeout when programming the flash

Description: An error occurred during programming. A memory cell in the flash could not be write accessed.

Clearing errors: Programming command repeated. If the error continues, then the firmware module ESF02.1 must be replaced.

0x96FF (dL / 09) Error when write accessing the RAM

Description: An error occurred during programming. A memory cell in the flash could not be write accessed.

Clearing errors: Check whether the target address is actually in the RAM. If the error continues, then the firmware module ESF02.1 must be replaced.

0x9701 (dL / 0d) Wrong checksum

Description: The programmed checksum is checked at the end of the updating of the firmware module. This check went wrong.

Clearing errors: Reprogram the module, check the checksum of the source file (*.ibf).

0x9702 (dL / 0e) CRC32 checksum faulty

Description: The programmed CRC32 checksum is checked at the end of the updating of the firmware module. This check went wrong.

Clearing errors: Reprogram the module, check the checksum of the source file (*.ibf).

Additional Problems when Loading Firmware

The programming of a module was terminated

Problems on the serial interface can lead to the termination of a transmission.

In the event that the loading procedure of the FBC module was terminated, then do not switch the unit off. This module is responsible for starting the firmware and therefore absolutely necessary.

A module that has not been completely programmed can simply be reprogrammed (open ibf file, press transmit button, in the "Send" window, select *Module single* and by *skipping,* find the right module. Now press the send button).

After the unit is switched on, the display reads dL

The last programming procedure with Dolfi was not correctly completed.

To leave the firmware loader on one or all of the modules of an *.ibf file must be programmed with Dolfi. The drive firmware is started by pressing the separate button.

Dolfi can be used to establish a connection

a) A baud rate other than Dolfi was set in parameter P-0-4021.

P-0-4021, Baud Rate RS-232/485:

Baud rate [Baud]	Setting in parameter P-0-4021
9600	0
19200	1

It is advisable to set parameter P-0-4021 to 0 for "Connecting process“ (=9600 Baud). The baudrate for the download can be set to a different value in Dolfi.

If the programming of a module was terminated, e.g., due to interference at a serial interface, then the baud rate for the download is still set in a DKC. For Dolfi to be able to re-establish a connection, it is necessary to set the connect rate to the same value with which the most recent download occurred.

If the unit was switched back on and if the display reads dL, then a baud rate of 9,600 is always set.

b) The receiver and unit address is not identical with the address set at the controler via switches S2 and S3.

Dolfi can not open the ibf file

Dolfi signals "Wrong ibf format“ when opening the ibf file.

The ibf file was generated with a different release and the ibf format has changed.

To open the file the correct Dolfi version must be used. This can be obtained from the manufacturer.

Dolfi signals timeout

Timeout messages appear while the ibf files are being transmitted. Interference at the serial connections could be the problem or the deactivated COM interface FIFO.

This can be activated as follows:

Windows 95:

Start → Settings → System control → System → Unit manager → Connections (COM and LPT) → COM connections (COMx) → Connection settings → Expanded

→ Activate FIFO, Use standard setting

Windows NT:

Start → Settings → System control → Connections → COMx → Settings → Expanded

→ Activate FIFO

Select the download baud rate

Depending on the length of serial interface cable there is a physical limit for the maximum baud rate at which serial communications runs without a fault.

The factory sets the maximum download baud rate at 19.2 kBd. The baud rate can be increased considerably in some applications which helps achieve a reduction in the time needed for a firmware update.

The following baud rates can be implemented at the specified cable lengths.

Cable length / m	max. baudrate / kBd
2	115.2
5	57.6
10	57.6
15	38.4

Fig. 3-20: Maximum baud rate as dependent on the cable length

4 Command Communication via Fieldbus

4.1 Bus-Dependent Features

Profile

For drive technology that uses a fieldbus system it was necessary to develop definitions for both process objects and status machines. Familiar are, for example, the DriveCom profile 22 of the Interbus Club, the ProfiDrive profile of the Profibus User Organization and the Drive Profile DS402 for CANopen protocols. These profiles control only a small part of the necessary functions of a drive. The additional and especially valuable functions continue to remain manufacturer-specific.

Indramat offers the user advanced drive functions with a simple-to-use interface. This is the case, for example, with the referencing and jogging functions in DriveCom which have been defined as an independent operating mode. These take the form (as defined in ProfiDrive as well) of a bit in the control word, thus offering the user a considerably more comfortable interface.

Long years of experience have optimized and tested the interface to the drive controller to perfection. The interface will, in the future, broadly depend on the bus system. The DriveCom and ProfiDrive functionalities, will, however, remain covered and only the position of the relevant bits in the control word might change. Additionally, all the operating modes defined in the drive will be accessible via the fieldbus.

Pertinent Parameters

The following parameters are relevant to external communications via a fieldbus:

- **P-0-4075, Fieldbus watchdog time**
- **P-0-4076, Fieldbus container object**
- **P-0-4077, Fieldbus control word**
- **P-0-4078, Fieldbus status word**
- **P-0-4079, Fieldbus baudrate**
- **P-0-4080, Real-time input object structure**
- **P-0-4081, Real-time output object structure**
- **P-0-4082, Length of real-time data channel In**
- **P-0-4083, Length of parameter channel in DP**
- **P-0-4084, profile type**
- **P-0-4085, Fieldbus version**
- **P-0-4087, Length of real-time data channel Out**

The following parameters are relevant to the internal data exchange between drive and communications card:

- **S-0-0001, NC Cycle time (TNcyc)**
- **S-0-0002, SERCOS Cycle time (Tscyc)**
- **S-0-0007, Feedback acquisition starting time (T4)**
- **S-0-0008, Command valid time (T3)**

Directory of Objects

For a simple access via the fieldbus, the process data of the drive controller are made available using the socalled object directory via the fieldbus. The following objects are made available independent of the type of fieldbus.

Index	Data type	Object type	Access	PD	Object description
6040	Oct. 2	Variable	R/W	yes	**P-0-4077, Fieldbus control word**
6041	Oct.2	Variable	R	yes	**P-0-4078, Fieldbus status word**
6064	i32	Variable	R	yes	**S-0-0051, Position feedback 1 value**
606C	i32	Variable	R	yes	**S-0-0040, Velocity feedback value**
607A	i32	Variable	R/W	yes	**S-0-0258, Target position**
6081	u32	Variable	R/W	yes	**S-0-0259, Positioning Velocity**
5FF1	u16	Variable	R/W	yes	**P-0-4076, Fieldbus container object**
5FF6	u16	Variable	R	yes	**S-0-0390, Diagnostic message number**)
5E70	u8	Array	R/W	no	data exchange object 16 bytes
5E71	u8	Array	R/W	no	data exchange object 32 byts
5E72	u8	Array	R/W	no	data exchange object 64 Byte
5E73	u8	Array	R/W	no	data exchange object 128 Byte

Fig. 4-1: Object directory (DriveCom)

*PD = can be transmitted as cyclical process data

Setting the Slave Address

The address is set on the inserted firmware module.

State at delivery: **Default address: 99**

The address of ECODRIVE03 is set to 99 at delivery.

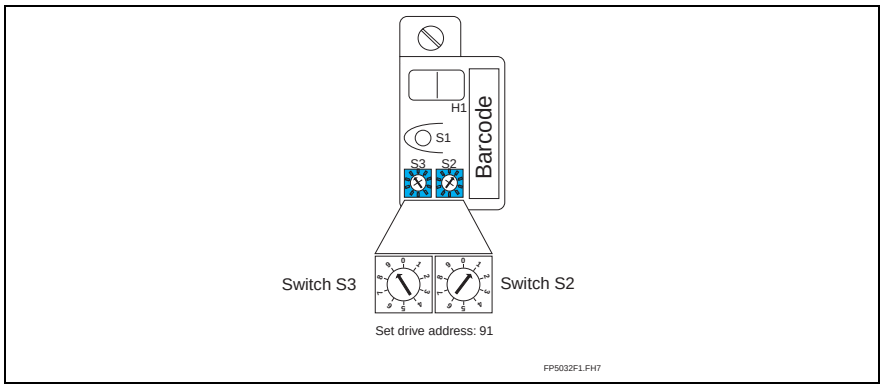


Fig. 4-2: Setting the slave address on the firmware module

Programmable addresses

The ECODRIVE03 controller supports

Slave addresses: 1...99 (decimal)

Note: The slave address 0 does not exist and may not be used in any applications.

Slave addres must be set before switching on!

ECODRIVE03's address is read out while the machine is running up into phase 3 and is used to parametrize the fieldbus circuit.

This means that a change in a slave address does not become effective until the drive controller has run up.

Drive Parametrization via Fieldbus

A parametrization of the drive requires the transmission of numerous parameters and lists that are retained in accordance with the SERCOS specification.

Parametrization is possible via:

- a serial interface (e.g., Drivetop)
- or a parameter channel of the fieldbus (e.g., PCP).

Data exchange objects

Data exchange objects used in conjunction with Indramat's SIS protocol, can be used to read/write all the parameters of the drive via the fieldbus.

Four data exchange objects with varying lengths are made available. These are only accessible via the acyclical services "**Read**" and "**Write**" of the relevant fieldbus.

Object	5E70	16	bytes	R/W
Object	5E71	32	bytes	R/W
Object	5E72	64	bytes	R/W
Object	5E73	128	bytes	R/W

INDRAMAT SIS protocol

Reading and writing a parameter complies with the rules set forth in the INDRAMAT SIS protocol.

Reading a parameter

A parameter of a drive cannot be directly read but rather a specific sequence must be maintained:

1. Read request of a Sercos parameter in SIS format ->Write
2. Read out of requested parameter in SIS format ->Read or error message (reaction telegram).

Writing a parameter

Writing a parameter also requires a specific sequence:

1. Write request of a Sercos parameter in SIS format->Write
2. Read out reaction telegram → read (confirm or error message).

Note: The complete coding rules of the SIS protocol are listed in a separate document.

Structure of an SIS command telegram

Every SIS command telegram is made up of:

- 7 bytes telegram header + start symbol
- 5 bytes user data header
- n bytes user data

Telegram header

Byte	Name	Definition
1	STZ	start symbol (0x02)
2	CS	checksum (not relevant with fieldbus!)
3	DatL	data length (incl. user data header) in bytes
4	DatlW	repeat DatL
5	Cntrl	control byte
6	Dienst	ECODRIVE services (see attachment C)
7	AdrS	**address** of sender
8	AdrE	**address** of receiver

Fig. 4-3: Telegram header of the command telegram

User data header

9	Ctrl - Byte	control byte in user data header
10	drive addr.	address ECODRIVE
11	ParaTyp	parameter type
12	ParaNumL	parameter number low byte
13	ParaNumH	parameter number high byte

Fig. 4-4: User data header of the command telegram

User data (max. 115 bytes)*

14	user data	user data, bytes (Intel format)
15	user data	user data, bytes (Intel format)

Fig. 4-5: User data

Note: *) The number of user data is determined by the data exchange object used.

Coding the control status and parameter information

Coding the parameter number and the parameter type.

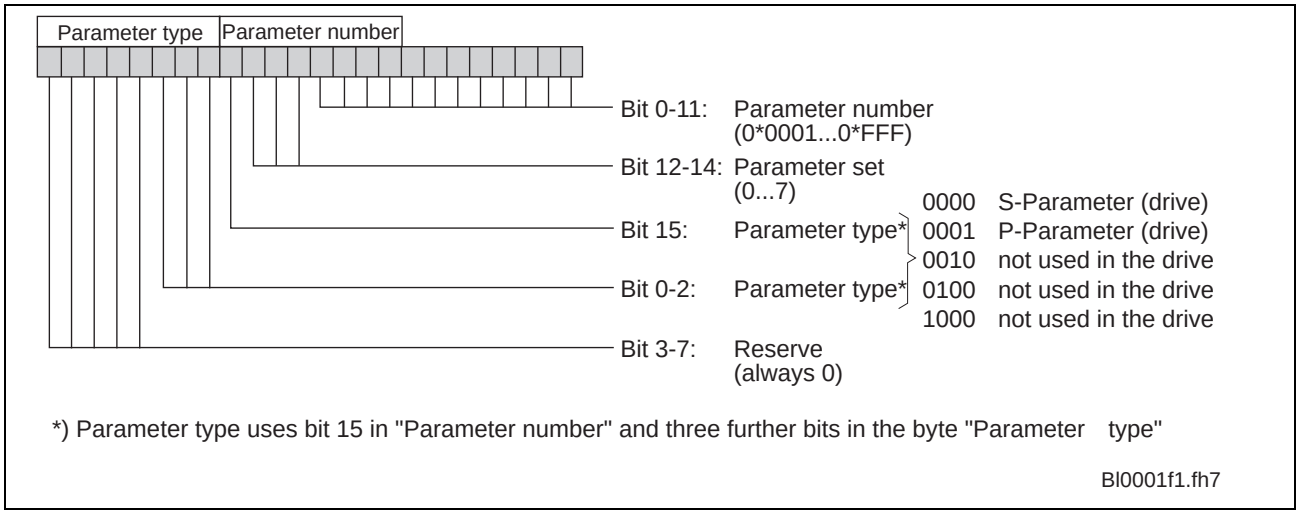

Parameter type
Parameter number
Bit 0-11: Parameter number (0*0001...0*FFF)
Bit 12-14: Parameter set (0...7)
Bit 15: Parameter type*
Bit 0-2: Parameter type*
Bit 3-7: Reserve (always 0)
0000 S-Parameter (drive)
0001 P-Parameter (drive)
0010 not used in the drive
0100 not used in the drive
1000 not used in the drive
*) Parameter type uses bit 15 in "Parameter number" and three further bits in the byte "Parameter type"
BI0001f1.fh7

Fig. 4-6: Bytes 11-13 in the user data header

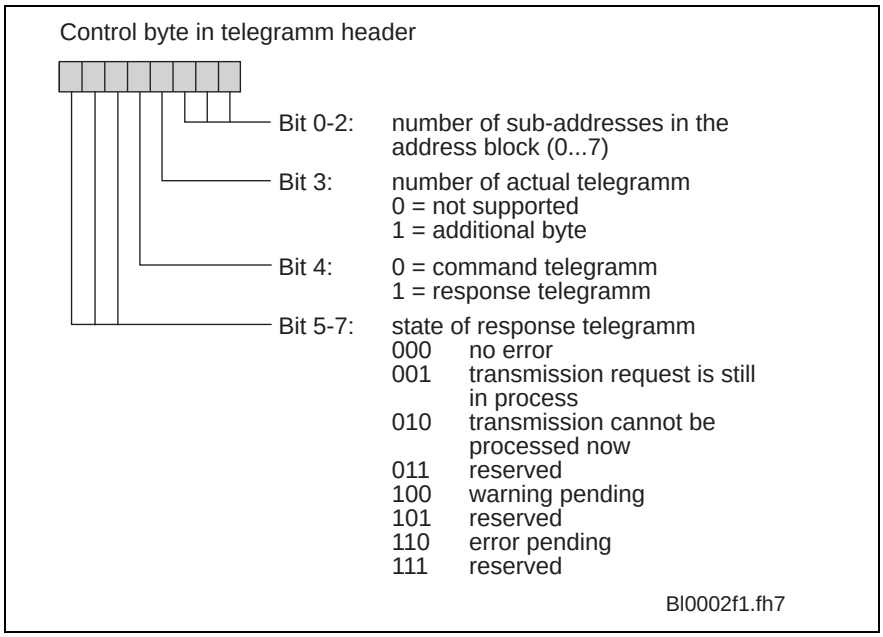

Control byte in telegramm header
Bit 0-2: number of sub-addresses in the address block (0...7)
Bit 3: number of actual telegramm
0 = not supported
1 = additional byte
Bit 4: 0 = command telegramm
1 = response telegramm
Bit 5-7: state of response telegramm
000 no error
001 transmission request is still in process
010 transmission cannot be processed now
011 reserved
100 warning pending
101 reserved
110 error pending
111 reserved
BI0002f1.fh7

Fig. 4-7: Control byte (Byte 5) in the telegram header

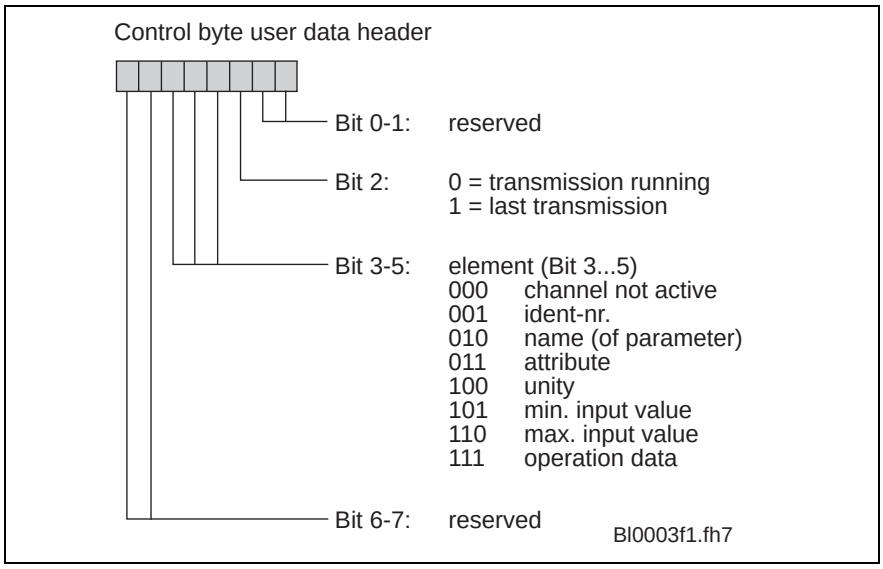


Fig. 4-8: Control byte (Byte9) in the user data header

Structure of a status byte in a reaction telegram

The status byte supplies the results of a transmission in the form of a code.

Transmission status	Code numbers
transmission without error	0x00
protocol error	0xF0... 0xFF
execution error	0x01.... 0xEF

Fig. 4-9: Transmission status in a reaction telegram

The following status information is presently in available:

Protocol error	Code	Error description
Invalid service	0xF0	The requested service is not specified or is not supported by the participant addressed.
general protocol violation	0xF1	The command telegram cannot be evaluated (e.g., telegram length wrong).

Fig. 4-10: Protocol error in the reaction telegram

Execution error	Code	Error description
parameter processing error	0x01	an error occurred while R/W a parameter
phase transition error	0x02	specified target phase not reached

Fig. 4-11: Execution error in the reaction telegram

Structure of the SIS reaction telegram

After sending a command telegram via a data exchange object, the drive makes a reaction telegram available.

This telegram can be read with a read service via a data exchange object.

The SIS reaction telegram either contains data to be read or a diagnosis. To know which, it is necessary to interpret the SIS telegram.

The structure of an SIS telegram is as follows:

Telegram header

Byte	Name	Definition
1	STZ	start symbol (0x02)
2	CS	checksum (not relevant with fieldbus!)
3	DatL	data length (incl. user data header) in bytes
4	DatlW	repeat Datl
5	Cntrl	control byte
6	Service	ECODRIVE services
7	AdrS	address of sender
8	AdrE	address of receiver

Fig. 4-12: Telegram header in the reaction telegram

User data header

9	Status	status byte in the user data header
10	Ctrl - Byte	control byte
11	AdrS	address of sender (unit address ECODRIVE)

Fig. 4-13:User data header in the reaction telegram

User date (max. 115 bytes)*

14	user data	user date, bytes (Intel format)
15	user data	user date, bytes (Intel format)

Fig. 4-14: User data in the reaction telegram

Using the data exchange object

The choice of a suitable data exchange object is exclusively determined by the field length of the data that is to be transmitted.

The field length must span the entire SIS telegram!

The structure of this protocol permits data block splitting so that even lists with more than 115 bytes + header can be transmitted.

Example : Reading a parameter

1. Sending a read request

An SIS telegram is to be used to read the data of SERCOS parameter **P-0-4082 (Length of the process data channel fieldbus**).

Telegram header

Byte	Name	Definition	Code
1	STZ	start symbol (0x02)	02
2	CS	checksum	xx
3	DatL	data length (incl. user data header) in bytes	05
4	DatlW	repeat Datl	05
5	Cntrl	control byte (command telegram)	00
6	Dienst	ECODRIVE services	80
7	AdrS	address of sender	00
8	AdrE	address of receiver *	05

Fig. 4-15: Telegram header in the command telegram (read P-0-4082)

User data header

9	Ctrl - Byte	control byte in user data header	3C**
10	drive addr.	address ECODRIVE	05
11	ParaTyp	parameter type	00
12	ParaNumL	parameter number low byte	F2*
13	ParaNumH	parameter number high byte	8F*

Fig. 4-16:User data header in the command telegram (read P-0-4082)

*) 0x8FF2 = Bit 15 = 1 -> parameter FF2 = 4082 Dez. -> P-0-4082

**) operating data, final transmission

2. Reading a reaction telegram

By reading a reaction telegram via a data exchange object the data are transmitted in SIS format to the master.

Telegram header

Byte	Name	Definition	Code
1	STZ	start symbol (0x02)	02
2	CS	checksum	xx
3	DatL	data length (incl. user data header) in bytes	05
4	DatlW	repeat Datl	05
5	Cntrl	control byte (reaction telegram)	10
6	Service	ECODRIVE services	80
7	AdrS	address of sender	05
8	AdrE	address of receiver	00

Fig. 4-17: Telegram header in the reaction telegram (read P-0-4082)

User data header

9	Status	status byte in the user data header	00
10	Ctrl bytes	control byte	3C
11	AdrS	address of sender (unit address ECODRIVE)	05

Fig. 4-18:User data header in the reaction telegram (read P-0-4082)

User data

14	user data	low byte P-0-4032	0C
15	user data	high byte P-0-4082	0D

Fig. 4-19:User data in the reaction telegram (read P-0-4082)

Note: The actual results, i.e., the contents of the parameter P-0-4082, are in bytes 14+15.

4.2 Command Communications with Profibus/DP

General Information

The drive controller ECODRIVE 03 has a profibus command communications module which supports the Profibus/DP protocol.

It is possible with this module to transmit real time data via the process data channel. A master that only supports Profibus/DP suffices.

Optional parameter channel

The drive can be parametrized via the optional parameter channel in the cyclical channel.

To achieve the greatest possible flexibility all process data of a system can be reached via an object. This object can be allocated to the process data channel as real time data which means that they can be cyclically transmitted.

Note: We recommend the use of the S7 module made by Indramat.

Function Overview

The Profibus command communications module has the following features:

- The command module supports interfaces in accordance with EN50170, vol. 2. Line types A and B as per EN50170, vol. 2, are also supported.
- All data rates as per EN50170, vol. 2, up to 12 Mbps if only Profibus DP is used.
- Configurable process data channel up to 16 words in both data directions.
- Downwards compatible to Profibus functions of the DKC3.1.
- Process data channel monitored (watchdog function).
- LEDs on the front panel of the command communications module for easy diagnoses of bus functions and important communications relationships between drive and fieldbus.
- Upload/download function for all drive parameters including lists of four arrays of 16 to 128 bytes data lengths with parameter channel are possible (INDRAMAT SIS protocol).

Profibus Interface

- To ensure EN standards for EMC safety, the profibus interface is completely galvanically decoupled.
- As per EN50170, vol. 2, the module has a 9-pin D-subminiature plug-in connector for coupling a Profibus.
- To switch through BUS signals to the other bus participants, INDRAMAT's plug-in connector INS 0450 is available.

Note: The BUS coupling as spur is directly in the plug-in connector INS 0450. Given transmission rates of >500kbit this particular plug-in connector must be used. There may not be any other spurs or additional plug-in connectors.

- To maintain the BUS functions it is necessary that the unit into which the connector with bus connection is inserted, is always in operation.

Setting a Slave Address and Transmission Rates

Note: Slave addresses 0 and 1 are reserved and may only be used for slave applications.

Parameter Channel in the DP

Note: The transmission rate is set in the master and automatically detected by the slave.

As it must be possible to parametrize the drive via the fieldbus, a configurable parameter channel has been implemented in the cyclical data of the ECODRIVE03. Its size has been set to one or six words.

Definition of Terms

Cyclical data channel

The fieldbus makes data containers available in which cyclical user data is transported. This is defined as the cyclical data channel.

This cyclical data channel is broken down into

- a process data channel (real time channel) and
- an (optional) parameter channel.

Process data channel

The real time channel (Process data channel) contains permanently programmed information. Thus the receiver can directly interpret this information.

Parameter channel

Parameters in general can be transported in the parameter channel. To read parameters, however, the PLC must first receive a read request in writing. This is why the parameter channel has no „Real time features“.

The cyclical data channel can be configured via the following parameters:

Parameter	Definition	I/O mode	Position setting
P-0-4082	**Length of real-time data channel In** (bytes)	2	24
P-0-4087	**Length of real-time data channel Out** (bytes)	2	24
P-0-4083,	**Length of parameter channel in DP** (bytes)	0	12

Fig. 2-4: Parameters to configure the cyclical data channel

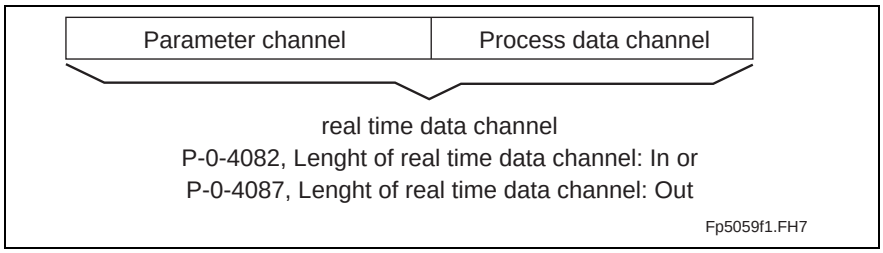

Parameter channel
Process data channel
real time data channel
P-0-4082, Lenght of real time data channel: In or
P-0-4087, Lenght of real time data channel: Out
Fp5059f1.FH7

Fig. 4-20: Structure of the cyclical channel

Note: The parameter channel is always at the start of the cyclical data channel. The length of the parameter channel and the length of the process data channel used to exchange real time data represent the entire length of the cyclical data channel. This is why the expansion of the parameter channel is at the expense of the size of the real time channel as the maximum size of the cyclical data channel is 16 words!

Object Directory Profibus Specific

As the assignment of the process data with Profibus/DP cannot be recognized either out of the unit or the GSD file, the description data out of Profile 12 of the Interbus was used.

Unit master file for DKC03.3

Every **Profibus DP unit** must have a master file **(*.GSD**) in which the data is stored that is needed to operate the unit on the BUS. This file is needed for each subscriber at the time when the Bus master is configured.

The unit master file for ECODRIVE03 is an ASCII file. Its designation is:

Unit master file for ECODRIVE03

EC03100D.GSD

The master file also contains the

ID number 100D hex

assigned by the PNO and needed for an ECODRIVE03.

Note: The GSD file is delivered with DriveTop.

Configuration of the Profibus/DP Slave

Configuration of the process data channel

For the user, the Profibus command communications module represents an intelligent Profibus module which can be configured into the process data section and has the capability to meet process demands.

The process data are configured independently of the fieldbus type.

The setting in **P-0-4084, Profile type** basically pre-determines the process data channel (real-time channel) setting.

Exception: In the case of profile type P-0-4084 = 0xFFFE configuration is left up to the user.

See also functional description: **Profile type**

Parametrization via the fieldbus is possible and the drive parameters can be write accessed via the parameter channel.

This configuration option, however, requries that the master implement the parameter channel. PLC modules are available for the S7 for this purpose.

Note: It applies to both the process input data and output data that changes in word length must always lead to modifications in the data stored in the master that were intended for the slave. This is why any changes in length of the DP channel do not become effective until after the drive is switched back on after being switched off or with the transition from phase 2 to 3.

P-0-4080, Real-time input object structure

The structure and thus the number of words and their assignment with objects (indices) for the process input data are illustrated in this parameter.

The master can use this configuration to inform itself about the situation of the individual real time data on the bus.

P-0-4081, Real-time output object structure

The structure of the process output data is stored in this parameter. Thus it is possible via this parameter channel to read the current structure and thus the assignment at the BUS.

Note: Up to 16 words in both data directions can be configured at the BUS.

Data direction

- **Data direction input**

The data direction input is the data transmission direction from slave to master.

- **Data direction output**

This data direction specifies data transmission from master to slave.

Length of the process data channel PD in ECODRIVE03

The parameter channel (optional) and the process data channel in which the real time data of the drive controller are transmitted, are allocated within the cyclical channel.

The Profibus slave circuit permits a flexible configuration of the process data channels.

The length of the process data channel depends on the profile type which has been set. Additionally, user-specific expansions of the process data channel can mean that the individual drive controllers have different input lengths.

Note: The default configurations are outlined in section: "Profile types".

The data types of the process data channel can only be words or double words, not bytes. Length is specified in bytes for the sake of compatibility to other bus systems.

The length of the process data channels can range between

Length of the PD channel

1to 16 words or 2 to 32 bytes in either direction.

Setting the length of the PD channel in ECODRIVE 03

The length of the PD channel is specified in the contents of the configuration lists in P-0-4080 or P-0-4081 and can be read in parameters

P-0-4082, Length of real-time data channel Int

P-0-4087, Length of real-time data channel Out

The setting is acceped once the driver controller switches up into phase 3. This is why it must be set beforehand. Any changes do not become effective until the controller has been switched off and on once or the drive runs up into operating mode.

Note: Please note that any change in length of the process data channel also means a change in the configuration of the master. The set length of the process data channel must therefore agree with the projected length in the master.

Diagnostic LEDs for Profibus

There are four LEDs on the front of the fieldbus module used in fieldbus interface diagnoses. These signal the synchronization state between fieldbus interface and drive as well as the bus activity for cyclical data exchange.

LED designation	LED state	Definition
H30	ON	cyclical process data channel active
H31	--	--
H32/H33	alt. flashing	fieldbus module and drive synchronized
H32/H33	steady flashing	fieldbus module and drive not synchronized

Fig. 4-21: Diagnostic LEDs for Profibus

Assigning Profibus Plug-In Connector X30

Signal assignment X30 Profibus connection

X 40	RS 485 refer.	INDRAMAT signal name	Signal per EN50170, vol. 2	Definitions
1		PE	shield	shield or PE
2		free		
3	B / B´	B	RxD/TxD-P	receive/send data P
4		CNTR-P	CNTR-P	repeater/control signal P
5	C / C´	BUSGND	DGND	data reference pot.
6		VP	VP	power supply plus (P5V)
7		free		
8	A / A´	A	RxD/TxD-N	receive/send data N
9		CNTR-N	CNTR-N	repeater control signal N

Fig. 4-22: Signal assignment on X30 Profibus connection

4.3 Command Communications with INTERBUS-S

General Information

The ECODRIVE03 uses an INTERBUS command communications module that supports protocol

INTERBUS-S with PCP channel, ver. PCP 2.0.

This module makes it possible to transmit both real time data via the process data channel and parameter and data via objects of the PCP, if the master supports PCP communication.

PCP channel use optional

To achieve the highest possible flexibility within the system, all process data can be reached via objects which can be allocated to the process data channel as real time data and thus are cyclically transmittable also.

The drive can be parametrized via the PCP services.

It is also possible to transmit via the acyclical in the channel by using the INTERBUS PCP. However, objects defined in the real time channel cannot be write accessed by the master via the PCP.

Note: The use of a master circuit that supports PCP 2.0 (G4) is recommended.

Functional Overview

The INTERBUS-S command module has the following features:

- INTERBUS-S real time channel and PCP 2.0 (G4) channel are supported.
- Configurable process data channel up to 16 words in both data directions. The configuration can be read/write via PCP object 6000 and 6001 or parameter P-0-4080 or P-0-4081 of the drive.
- Process data channel monitored (watchdog function).
- LED diagnosis field on front panel of command module to simplify diagnoses of BUS functions and the most important communications between drive and fieldbus.
- Upload/download function for all parameters of the drive including lists of four arrays of 16 to 128 byte data lengths serviced with PCP (Indramat SIS prococol).

INTERBUS-S Interface

The command communications module supports the

INTERBUS-S remote bus interface

Baudrate

The baudrate of the INTERBUS is exclusively 500 Kbit-

- To ensure EN standards for EMC safety, the Interbus interface is completely galvanically decoupled.
- As per DIN 19258, sec. 2, the command module has two 9-pin D-subminiature plug-in connectors for coupling onto the INTERBUS remove bus (incoming and outgoing lines).

- Due to signal coupling (repeater function) and to maintain the BUS function, the module must always be operational. The diagnosis of the most important BUS functions can be read out on the LEDs on the front of the module.

Setting Slave Addresses and Transmission Rates (bus-specific)

Note: It is not possible to set either the slave address or the baudrate with Interbus!

The baudrate is and must remain 500kBaud. As a result of the ring structure of the Interbus, both position and slave address within the ring are fixed. This address is also used with the PCP as KR address.

PCP services

ECODRIVE 03 supports PCP 2.0 version of the Phoenix contact with a 1 word PCP length. Optionally a four-word length can be also be set via P-0-4083.

The use of a master circuit of the G4 group is recommended. However, a G3 master can also be used without restrictions.

The following services are supported:

- **Initiate** establish connection
- **Abort** terminate connection
- **Reject** reject unallowed services
- **Identify** read manufacturer name, type, version
- **Status** read unit/user status
- **Get-OV** read object directory
- **Read** read variable
- **Write** write variable

Additional data and services are listed in the literature of the specific master circuit.

Object Directory Interbus-specific

Index	Data type	Object type	Access	PD	Object description
6000	PDB	Record	R	no	**P-0-4080, Real-time input object structure**
6001	PDB	Record	R	no	**P-0-4081, Real-time output object structure**
6002	Bool	Variable	R/W	no	Process output data released
6003	u16	Variable	R/W	no	Process data monitoring time

Fig. 4-23: Object directory for Interbus

Configuration of INTERBUS Slave

Configuration of the PCP-channel

The maximum object length must be set to 240 bytes.

Configuration of process data channel

The INTERBUS command communications module makes available to the user an intelligent INTERBUS module that can be configured to meet process demands in the process data section.

The process data is configured independent of the fieldbus type. Usually, the setting of parameter **P-0-4084, profile type** suffices.

Parametrization via the fieldbus is also possible within which the drive parameters can be write accessed using the data exchange objects SE70 to SE73 via the PCP channel.

The set values of these parameters can be read via the data exchange objects. Alternately, objects 6000/6001 defined in profile 12 (sensor/actuator) can also be read via the PCP channel.

However this configuration option requires that the master supports the PCP services.

Note: It applies to both the process input data and output data that changes in word length must always lead to modifications in the data stored in the master that were intended for the slave. This is why any changes in length of the DP channel do not become effective until after the drive is switched back on after being switched off or with the transition from phase 2 to 3.

P-0-4080, Real-time input object structure
(Object 6000)

The structure and therefore the number of words and their assignment with objects (indices) for the process input data is illustrated in this parameter.
The user can read the existing structure via the PCP read service.

The master can use this configuration to obtain information about the positon of the individual objects in the BUS.

P-0-4081, Real-time output object structure
(Object 6001)

The structure of the process output data is stored here. This means that the current structure and BUS assignment can be read out on the PCP.

Data direction

- **Data direction input**

This means slave to master.

- **Data direction output**

This means master to slave.

Process data input description Object 6000

The process data input description is stored in object 6000. The default configuration example illustrates the structure of this object.

Basic structure:

- The structure of the process data descriptoin is fixed in profile 12 of the INTERBUS.
- The length of object 6000 is fixed by the maximum number of words on the BUS.
- The BUS length is entered in bytes (hexadecimal) in the first byte of object 6000.

- The entries for each byte on the bus follow this in rising order. For each byte, an object number (index) must be entered and an additional byte for any sub-indices held ready. This byte is always zero!
- If an object is made up of several bytes (standard for ECODRIVE 03 is a word structure of at least two bytes), then the entry for the object number is only for the first byte. The object number for the rest of the bytes is always zero.

Example:

	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Data-Out	6040	607A H	607A L	6081 H	6081 L	5FF1
Data -IN	6041	6064 H	6064 L	606C H	606C L	5FF6

Fig. 4-24: Default configuration for BA 1; position target setting

Byte no.:	Value	Definition:
1	0x0C	bus length PD in Byte
2	0x60	1 byte on bus; 6041
3	0x41	1 byte on bus; 6041
4	0x00	sub-index for object 6041 (always 00)
5	0x00	2 byte on bus; still for object 6041(word)
6	0x00	2 byte on bus; still to object 6041
7	0x00	sub-index for object 6041 (always 00)
8	0x60	3 byte on bus; 6064 H
9	0x64	3 byte on bus; 6064 H
10	0x00	sub-index for object 6064 (always 00)
11	0x00	4 byte on bus; still to object 6064 H (D word)
12	0x00	4 byte on bus; still to object 6064 H (D word)
13	0x00	Sub-index for object 6064 (always 00)
14	0x00	5 byte on bus; still to object 6064 L (D word)
15	0x00	5 byte on bus; still to object 6064 L (D word)
16	0x00	sub-index for object 6064 (always 00)
17	0x00	6 byte on bus; still to object 6064 L (D word)
18	0x00	6 byte on bus; still to object 6064 L (D word)
19	0x00	sub-index for object 6064
20	0x60	7 byte on bus; object 606C H
21	0x6C	7 byte on bus; object 606C H
22	0x00	sub-index for object 606C
23	0x00	8 byte on bus; still object 606C (D word)
24	0x00	8 byte on bus; still object (D word)
25	0x00	sub-index for object 606C
26	0x00	9 bytes on BUS; still to object 606C L (D word)
27	0x00	9 bytes on BUS; still to object 606C L (D word)
28	0x00	Sub-index for object 606C
29	0x00	10 byte on bus; still to object 606C L
30	0x00	10 byte on bus; still to object 606C L
31	0x00	sub-index for object 606C
32	0x5F	11 byte on bus; object 5FF6 (word)
33	0xF1	11 byte on bus; object 5FF6 (word)
34	0x00	sub-index for object 5FF6
35	0x00	12 byte on bus; still to object 5FF6
36	0x00	12 byte on bus; still to object 5FF6
37	0x00	sub-index for object 5FF6

Fig. 4-25: Object 6000 Process input data

Process data output description object 6001

The process data output description is stored in object 6001. It contains position and number of output words on the BUS. The structure corresponds complete to the process input data description in object 6000,but with the relevant objects.

The description relates to the following default configuration for the profile type "Position target default".

Example:

	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6
Data-Out	6040	607A H	607A L	6081 H	6081 L	5FF1
Data -IN	6041	6064 H	6064 L	606C H	606C L	5FF6

Fig. 4-26: Default configuration

Byte no.:	Value	Definition:
1	0x0C	Bus length PD in Byte
2	0x60	1 byte on bus; 6040
3	0x40	1 byte on bus; 6040
4	0x00	Sub-index for object 6040 (always 00)
5	0x00	2 byte on bus; still to object 6040 (Word)
6	0x00	2 byte on bus; still to object 6040
7	0x00	Sub-index for object 6040 (always 00)
8	0x60	3 byte on bus; 607A H
9	0x64	3 byte on bus; 607A H
10	0x00	Sub-index for object 607A (always 00)
11	0x00	4 byte on bus; still to object 607A H (D word)
12	0x00	4 byte on bus; still to object 607A H (D word)
13	0x00	Sub-index for object 607A (always 00)
14	0x00	5 byte on bus; still to object 607A L (D word)
15	0x00	5 byte on bus; still to object 607A L (D word)
16	0x00	Sub-index for object 607A (always 00)
17	0x00	6 byte on bus; still to object 607A (D word)
18	0x00	6 byte on bus; still to object 607A (D word)
19	0x00	Sub-index for object 607A
20	0x60	7 byte on bus; Object 6081 H
21	0x6C	7 byte on bus; Object 081 H
22	0x00	Sub-index for object 6081
23	0x00	8 byte on bus; still object 6081 H (D word)
24	0x00	8 byte on bus; still object 6081 H (D word)
25	0x00	Sub-index for object 6081
26	0x00	9. Byte am BUS; still to object6081 L (D word)
27	0x00	9. Byte am BUS; still to object6081 L (D word)
28	0x00	Sub-index for object 6081
29	0x00	10 byte on bus; still to object 6081 L
30	0x00	10 byte on bus; still to object 6081 L
31	0x00	Sub-index for object 6081
32	0x5F	11 byte on bus; Object 5FF1 (Word; Dummy)
33	0xF1	11 byte on bus; Object 5FF1 (Word; Dummy)
34	0x00	Sub-index for object 5FF1
35	0x00	12 byte on bus; still to object 5FF1
36	0x00	12 byte on bus; still to object5FF1
37	0x00	Sub-index for object 5FF1

Fig. 4-27: Object 6000 process output data

Length pf process data channel in the ECODRIVE 03

The INTERBUS slave circuits permits a flexible configuration of the process data channel. The entire cyclical data channel for input and output data is defined as the process data channel. Within the process data channel both the parameter channel (optional) and the real time channel in which the drive's cyclical data are transmitted, are located.

The length of the process data channel depends on what is set in **P-0-4084, profile type**. In the freely configurable profile types (P-0-4084 = 0xFFFE) user-specific expansions of the process data channel can mean that drive controllers are operated with different lengths of the process data channel.

Note: Dummy bytes are automatically added in this case to make the lengths equal.

The process data channel can only have words or double words not bytes as a data type. The lengths are fixed in bytes in terms of the compatibility to other bus systems.

Length of the PD channel

The length of the process data channel must equal

1... 16 words or 2...32 bytes

in both directions with the same lengths.

Setting the length of the PD channel in the ECODRIVE 03

The length of the PD channel corresponds to the contents of the configuration lists in P-0-4080 or P-0-4081 and can be read out of parameters

- **P-0-4082, Length of real-time data channel In**
- **P-0-4087, Length of real-time data channel Out**

The setting is accepted when the drive switches into phase 3

Note: Any change in the length of the process data also means a change in the configuration of the master. The length of the process data channel must agree with the projected length in the master.

With Interbus it applies: **P-0-4082 = P-0-4087!**

The length set in the SERCOS parameters P-0-4082 or P-0-4087 is accepted directly by the INTERBUS slave circuit into objects 6000 and 6001 so that it is also possible to read out the configuration via the PCP.

Diagnostic LEDs for INTERBUS

The LEDs on the Interbus of the DKC04.3 meet the requirements for an INTERBUS certification.

	LED designation	LED status	Definition
Remote Check	H40/RC	green	command cable OK
Bus Active	H41/BA	green	data exchange active
Transmit/ receive	H42/TR	green	PCP transmission active
Remote bus disable	H43/RD	red	continuing remote bus segments off
Module status	H44	green flashing	Communication fieldbus drive OK
	H44	orange flashing	Communication fieldbus drive faulty
	H44	red	Initialization failed. Module defective
LED operation	H45/UL	green	voltage source OK

Fig. 4-28: Diagnostic LED for INTERBUS

Assignment Interbus-S - connectors X40 / X41

Note: Both connections and signal assignments meet DIN 19258/ section 2 demands.

Signal assignment X40, Interbus-S, incoming bus

X40	Signal	Designation	X40	Signal	Designation
1	DO 1	Out RS 485	6	/DO 1	Out RS 485
2	DI 1	IN RS 485	7	/DI 1	IN RS 485
3	GND 1	Reference potential	8	---	Not used
4	---	Not used	9	---	Not used
5	---	Not used	-	---	---

Fig. 4-29: Signal assignment X40, Interbus-S, incoming bus

Connector: 9pin D-subminiature connector strip

Signal assignment X41, Interbus-S, outgoing bus

X40	Signal	Designation	X40	Signal	Designation
1	DO 2	Out RS 485	6	/DO 2	Out RS 485
2	DI 2	IN RS 485	7	/DI 2	IN RS 485
3	GND 2	Reference potential	8	---	Not used
4	---	Not used	9	RBST	Remote BUS controls
5	+5V 2		-		

Fig. 4-30: Signal assignment X41, Interbus-S, outgoing bus

Connector: 9pin D-subminiature bushing strip

4.4 Command communications with CANopen

General Information

A CANopen communications module is available for use by an ECODRIVE 03. It supports protocol

- **CANopen per DS301 version 3.0**

With this module it is possible to transmit both real time data via the socalled process data objects (PDO) and parameters and data via the Service data objects (SDO) of the CANopen services.

The real time data are always transmitted with PDO.

To achieve the greatest possible system flexibility, all data can be reached via objects. These objects can be allocated as real time data to the process data channel and thus also be cyclically transmitted. The option of transmitting via an acyclical channel with SDO is also possible, but the master may not write access any of the objects defined in the real time channel.

Functional Overview

The CANopen command communication module has the following features:

- Simple configuration due to the use of predefined connection set and boot-up per DS301
- The baudrates specified by CANopen (per DS301) of 20, 50, 100, 125, 250, 500 kbps and 1 Mbps, except for 800 kbps, are supported.
- Freely configurable process data channel but not with up to 16 words in both data directions via SERCOS parameters of the drive.
- Downward compatible to Profibus functions of the ECODRIVE 01 by switching operating modes is possible.
- Monitoring of the process data channel (watchdog function)
- Diagnostic LEDs on the front of the module for simple diagnoses of BUS functions and important communications relationships between drive and fieldbus.
- Upload/download function for all parameters of the drive lists including four arrays of 16 to 128 byte data length with SDO services possible (INDRAMAT SIS protocol).

CANopen Interface

The command communication module supports

CANopen specification per DS301

- To ensure EN standards for EMC safety, the CANopen interface is completely galvanically decoupled.
- As per DS301 the command communications module has a 9 pin Dusubminiature connector to couple to the bus. Assignment corresponds to DS301.

Setting the Slave Address and Transmission Rates (bus-specific)

Adressing the CANopen slave

Prioritization

The address determines the priority of the slave message whereby the lowest address has the highest priority. Generally, the master has the highest priority and thus the lowest address.

Predefined Connection Set

Each CANopen subscriber on the bus must send those messages that are allocated to him. As per **Predefined Connection Set** of DS301a bus-wide unequivocal address of the slave is thus necessary. This address is set on the inserted firmware module.

Note: As per CANopen an address in the range of 1..127 can be set. With a DKC05.3 it is only possible to set addresses up to 99 maximum.

SDO Services

The DKC05.3 supports the service data objects (SDO) defined in the Predefined Connection Set of CANopen DS301.

For further information about services, see the literature of the master circuit.

Electronic Data Sheet for DKC05.3

For each **CANopen unit** there must be an EDS file **(*.EDS**) in which the data needed to operate the unit on the BUS are stored. This file is needed for the configuration of the BUS master for each participant.

The EDS file for an ECODRIVE03 is an ASCII file designated with

File name: **EC03CAN.EDS**

All the objects in the unit are described in this EDS file.

Note: The EDS file comes with the "DriveTop" program.

Object Directory CANopen specific

The communications objects defined by CANopen in DS301 are made available here. All objects are in the EDS file.

Configuration of CANopen Slave

Configuration of the process data channel (PDO)

The process data are configured indepdent of the fieldbus type.

With the CANopen command communication module the user has at his disposal an intelligent module configured to correspond to process demands.

The setting in **P-0-4084, profile type** generally also configures the process data channel (real time data channel).

Note: With profile type P-0-4084 = 0xFFFE the user must configure.

See also functional description: Profile type.

Parametrization can use the fieldbus in which the drive parameters can be write accessed using the data exchange objects via the SDO.

The values of this parameters can also be read via the data exchange objects. Alternately, it is possible to read via the SDO, the in DS301 defined PDO mapping objects 1600/1A00.

The configurations entered in the parameters are accepted once the drive runs up to phase 3.

P-0-4080, Real-time input object structure

PDO mapping objects 1A00, 1A01, ...

The structure of of the PDO sent from slave to master is described here as well as the length and assignment of the PDO with objects (indices) for the process input data.

The user can read out any existing structures via the SDO read services.

The master can use this configuration to know which object is transmitted into which PDO at which location.

Note: Up to 2 PDO can be configured with 8 byte length in both data directions.

P-0-4081, Real-time output object structure

PDO mapping objects 1600, 1601, ...

The structure of the proccess output data is stored here (master→slave). The current strucdture can be read out here via SDO along with the assignment of the PDO.

Note: It applies to both the process input data and output data that changes in word length must always lead to modifications in the data stored in the master that were intended for the slave. This is why any changes in length of the DP channel do not become effective until after the drive is switched back on after being switched off or with the transition from phase 2 to 3.

Data direction

- **Data direction input**

This means slave to master.

- **Data direction output**

This means master to slave.

Number and length of PDO in ECODRIVE 03

The CANopen slave circuit permits a flexible configuration of the process data channel. The process data channel in CANopen is broken down into PDO process data objects.

Length and number of PDOs depend on what is set in **P-0-4084, profile type**. It is also possible with the freely-configurable profile types (P-0-4084 = 0xFFFE) to make user-specific expansions in the process data channel meaning that the drives can operate with different PDO configurations.

Since all data of the drive are at least two bytes long a PDO can only contain a word or a double word, not bytes as data types. The lengths are fixed by the compatibility to other bus systems in bytes.

The configuration of length is generally automatic and determined by the operating mode. By reducing the values P-0-4082 or P-0-4087 the length and the number of PDOs to be transmitted can be reduced.

Note: A double word may never be divided into 2 PDOs.

The length of the process data channel can presently equal (max. 2 PDO)

Length of the PD channel P-0-4082, P-0-4084

2...16 bytes

for both directions separately.

The transmission is data consistent over the entire length.

Diagnoses for LED for CANopen

For fieldbus interface diagnoses there are six LEDs on the front of the fieldbus module. These signal the state of synchronization between fieldbus interface and drive as well as bus activity for cyclical data exchange.

Each LED can accept any of the four states, namely, red, green, orange and off .

When running up the CANopen module, the LEDs are automatically tested which can be seen by the glowing the various colors.

LED definition when module in operation:

	LED design.	**LED state**	**Definition**
intern synchronization	H50	orange flashing	no synchronization of fieldbus module with drive
		red/green flashing	synchronization of fieldbus module with drive established
--	H51	--	--
--	H52	--	--
SYNC	H53	orange	SYNC messages are being received. The LED toggles with each received SYNC from red to green. with the generally high frequencies, the prisma appears orange.
Initialization	**H54**	red	Initializing failed, module defective
		green	**module OK**
LED	**H55**	red	Operating error (Bus off). Too many errors on bus detected. Possible causes: • wrong baudrate • cable defective
		green	**operation OK**

Fig. 4-31: Diagnoses for LED for CANopen

Assignment of CANopen Connectors X50

The 9-pin D-subminiature connector meets CANopen standard DS102 and has the following signal assignment:

9-pin D-Subminiature connector

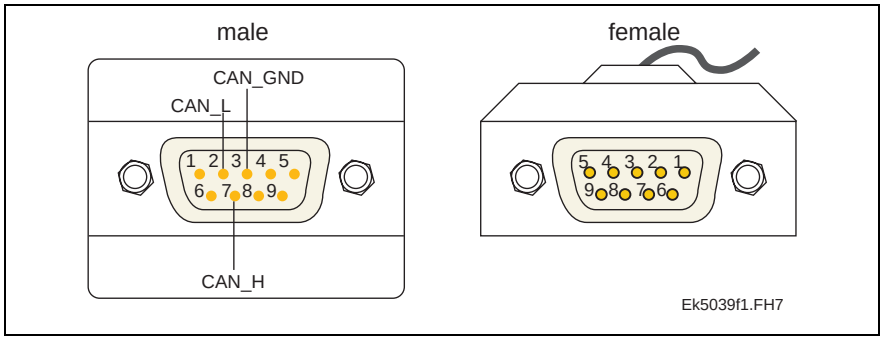


Fig. 4-32: 9-pin D-Sub connector

Pin	Signal	Description
1	-	reserved
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN ground
4	-	reserved
7	CAN_H	CAN_H bus line (dominant high)
8	-	reserved

Fig. 4-33: Connector assignment of X50

5 Profile Types

5.1 General Introduction

Overview of the Profile Types Supported

P-0-4084, profile type	DKC	Compati-bility	Fieldbus or Drive type	Functional Description
FF80h	3.3 4.3 5.3	PDP03vrs FGP01vrs	I/O mode with block acknowledge (BA: positioning block mode)	Ensures downwards compatibility to DKC3.1. Control and status words have same structure and definition!
FF81h	3.3 4.3 5.3	new	I/O mode with cam status (BA: positioning block mode)	As with 0xFF80 but travel block not acknowledged instead cam status bits 0-7 are set in status word
FF82h	3.3 4.3 5.3	new	I/O mode with cam status (BA: positioning block mode) + expandable real time channel	As with 0xFF81 but in addition to control and status words, expandable real time data can be configured
0001h	3.3 4.3 5.3	FGP01vrs -> not supported as of version 03	target position set (profile 22) (BA: drive-internal interpolation)	Similar to DRIVECOM target position set (profile22) with relevant control and status words.
0003h	3.3 4.3 5.3	-> not supported as of version 03!	speed control 2 (BA: speed control with filter and ramp)	Similar to DRIVECOM-speed control 2, with relevant control and status words after profile22.
FF91h	3.3 4.3 5.3	new	drive internal interpolation (without profile implementation)	real time data needed for drive-internal interpolation are preconfigured control and status words have Indramat-specific structure
FF92h	4.3 5.3	new	cyclical position control (with encoder 1) (without profile implementation)	real time data needed for cyclical position control are preconfigured control and status words have Indramat-specific structure
FF93h	3.3 4.3 5.3	new	speed control with filter and ramp (without profile implementation)	the real time data needed for speed control are preconfigured control and status words have Indramat-specific structure
FFFEh	3.3 4.3 5.3	new	freely configurable operating mode (BA*: freely programmable) (without profile implementation)	The configuration of the real time data is completely up to the user. control and status words have Indramat-specific structure This is suitable for • operation with analog interface • use of the complete drive functionality via fieldbus.

Fig. 5-1: Profile types supported: FWA-ECODR3-FGP-02VRS

*) BA: operating mode

Allocation to the Drive-Internal Modes

Operating modes used

By setting **P-0-4084**, **profile type,** the interpretation of the control and status words is not just profile dependent but this also simultaneously preselects a main operating mode within the drive!

The following relationship exists between

P-0-4084, profile type and **S-0-0032, Primary mode of operation**:

- I/O mode with 16Bit status and control words
  (P-0-4084=0xFF80 → downwards compatible to DKC3.1!)
  "positioning block mode without lag error"
- Target position setting (DRIVECOM profile 22)
  "drive-internal interpolation"
- speed control 2
  "speed control with filter and ramp"
- position control with cyclical position command value setting
  (only CAN open and Interbus)
  "cyclical position control"
- drive-internal interpolation
  "drive-internal interpolation without lag error" set
- speed control
  "speed control with filter and ramp"
- freely configurable mode
  → no profile dependent setting and checks
  → not status machine
  → configuration of real time channel with **P-0-4080** and **P-0-4081**
  → enables analog mode for commissioning

Note: Jogging is set as first auxiliary mode in all settings with the exception of the freely configurable mode.

5.2 I/O Mode

Basic I/O mode function

- The main operating mode positioning block mode is set. See also operating mode: positioning block mode".
- In this operating mode permanently programmed positioning blocks are selected via the 16 bit wide control word and started (as with DKC3.1).
- Jogging set as first auxiliary mode!
  See Operating mode: jogging".
- The parameter channel in Profibus-DP can be expanded to six words with the use of **P-0-4083**. (Default: **P-0-4083** = 0 → without parameter channel.)
- One control and status words are transmitted via the bus (16Bit). It is defined in the following text.

I/O Mode-Default Setting

The features of I/O mode default setting are:

- I/O mode in the real time channel is made up of one word, control or status word.
- Fixed length of this channel is 2 bytes. This follows the length of the cyclical data channel (**P-0-4082** = **P-0-4087** = 2 + **P-0-4083**)!

Note: By selecting this profile, compatibility to the DKC3.1s is established. In controls with real time data in Motorola format the high and low bytes are reversed in contrast to the DKC3.1!

The real time channel in I/O mode:

Master → Slave

In the real time channel of the fieldbus, the data configured in **P-0-4081, Real-time output object structure**are transmitted from master to the drive.

Parameter	Format	Object
• **P-0-4077, Fieldbus control word**	i16 -> (1 word)	5FE0

Slave → Master

In the the real time channel of the fieldbus, the data configured in **P-0-4080, Process data input description** are transmitted from master to the drive.

Parameter	Format	Object
P-0-4078, Fieldbus status word	i16 -> (1 word)	5FE1

Data order in the real time data channel:

	Word1
Master → Slave	**P-0-4077, Fieldbus control word**
Slave → Master	**P-0-4078, Fieldbus status word**

Fig. 5-1: Real time data channel contents

Structure of **P-0-4077, Fieldbus control word** (P-0-4084 =0xFF80)

Bit	Assignment	Description
0	drive enable	1: drive enable 0: drive disable (**S-0-0134**, Bit14)
1	drive start	1: drive start 0: drive halt (**S-0-0134**, Bit13)
2	drive-controlled homing (referencing)	1: command "C6" start 0: command "C6" end (**S-0-0148**= 0b)
3	strobe	0>1: change travel block **(S-0-0346)**
4	positioning with limited speed	1: limited speed
5	reset error	1: clear error command "C5" start **(S-0-0099)** 0: command "C5" end
	Jog +	1: jog forward (**P-0-4056**, Bit0)
7	Jog -	1: jog backwards (**P-0-4056**, Bit1)
8 - 13	select travel block	**P-0-4026**, **Process block selection**(Bit 0 - Bit6)
14-15	not assigned	

Fig. 5-2: Structure P-0-4077 ,Fieldbus control word in I/O mode

Structure of **P-0-4078, Fieldbus status word** (P-0-4084=0xFF80)

Bit	Assignment	Description
0	Operating mode	1: jogging 0: positioning
1	path switching point (WSP)	1: to the right of WSP 0: to the left of WSP (**P-0-0135**, Bit0)
2	in reference	1: drive is referenced (**S-0-0403**, Bit0)
3	in motion	1: in motion (**S-0-0013**, Bit1)
4	in position	1: drive within positioning window & no slave block (**S-0-0182**, Bit12)
5	error flag	1: no error (**S-0-0135**, Bit13) 0: error
6	ready display BB	1: ready (**S-0-0135**, Bit14)
7	power display AB	1: power on (**S-0-0135**, Bit15)
8 - 13	Travel block acknowledge	**P-0-4051, Process block acquittance** (Bit 0 - Bit6) inverted block preselect not inverted, block running
14-15	not assigned	

Fig. 5-3: Structure fieldbus status word

I/O mode with cam (P-0-4084= 0xFF81)

Features of I/O mode with cam

- Fixed real time channel length of 2 bytes. This follows the length of the cyclical data channel **P-0-4082** = **P-0-4087** = 2 + **P-0-4083**)!
- Instead of travel block acknowledge, 8 cam bits are transmitted in Bit8 - Bit15 of the fieldbus status word.
- In addition to Bit8 - Bit15, Bit0 and Bit1 of **P-0-4078**, **Fieldbus status word** also have changed their significance in terms of the downwardly compatible profile type!

The real time channel in I/O mode:

The contents of the real time data channel are identical to that of the I/O modewith travel block acknowledge (P-0-4084= 0xFF80).

Structure of P-0-4077, fieldbus control word (P-0-4084 =0xFF81)

Note: The structure corresponds to the control word of the profile type **P-0-4084** = 0xFF80!

Structure of P-0-4078, Fieldbus status word (P-0-4084 =0xFF81)

Bit	Assignment	Definition
0	Warning	1: active (**S-0-0135**, Bit12) 0: not active
1	E-stop status	1: active (**P-0-0223**, Bit0) 0: not active
2	in reference	1: drive is referenced (**S-0-0403**, Bit0)
3	in motion	1: in motion (**S-0-0013**, Bit1)
4	in position	1: drive within positioning window (**S-0-0182**, Bit12)
5	error	1: no error (**S-0-0135**, Bit13) 0: error
6	ready BB	1: ready (**S-0-0135**, Bit14)
7	power AB	1: power is on (**S-0-0135**, Bit15)
8 - 15	cam status	cam status bit 0 - 7 of **P-0-0135**

Fig. 5-4: Structure P-0-4078, fieldbus status word

I/O mode freely expandable (P-0-4084= 0xFF82)

Features of I/O mode freely expandable

- Length of cyclical data channel **P-0-4082** or **P-0-4087** can be user configured with up to 16 words. In addition to the fieldbus control and status words, additional real time data can be configured via ID lists **P-0-4080** and **P-0-4081**.
- **P-0-4077, Fieldbus control word** built up like I/O mode with cams (**P-0-4084** = 0xFF81)
- **P-0-4078, Fieldbus status word** built up like I/O mode with cams (**P-0-4084** = 0xFF81)

5.3 Profile Type, Target position setting

Features

- (P-0-4084= 0x0001) When selecting the profile type target position setting (Similar to Drivecom profile 22) the digital drive controller is controlled by a status machine which checks the internal states of the drive and generates **P-0-4078, Fieldbus status word**.
- Via **P-0-4077, Fieldbus control word** it is possible to set the on sequence for the status machine which takes the drive from its basic status (no drive enable) to drive enable "AF".
- Main operating mode **drive-internal interpolation** is set.
- 1st auxiliary mode is **jogging.**
  Also see Operating mode: jogging".
- **P-0-4077, Fieldbus control word** (object 6040) contains the structure defined with profile 22.

- **P-0-4078, Fieldbus status word** (object 6041) contains the structure defined with profile 22.
- The contents of the real time data channel are fixed with **P-0-4084, Profile type**.
- The parameter channel can be expanded with Profibus-DP to six words with **P-0-4083.** (Default: **P-0-4083** = 0 → without parameter channel)!
- Length of cyclical data channel fixed with:
  P-0-4082 = **P-0-4087** = 12 bytes + **P-0-4083**
- The target position block data for the target position can be set by the master if the status machine is in "ready enabled".
- The target position block data is accepted with a data handshake of signals:
  - "new command" (**P-0-4077**, Bit 4)
  - "command acknowledge" (**P-0-4078**, Bit 12)

Structure of the real time data channel

Master → Slave

In the real time channel of the fieldbus, the data configured in **P-0-4081, Process data output description** are transmitted from master to the drive.

Parameter	Format	Object
P-0-4077, Fieldbus control word	i16 -> (1 word)	6040
S-0-0258, Target position	i32 -> (2 words)	607A
S-0-0259, Positioning Velocity	i32 -> (2 words)	6081
P-0-4076, Fieldbus container object	i16 -> (1 word)	5FF1

Slave → Master

In the real time channel of the fieldbus, the data configured in **P-0-4080, Process data input description** are transmitted from master to the drive.

Parameter	Format	Object
P-0-4078, Fieldbus status word	i16 -> (1 word)	6041
S-0-0051, Position feedback 1 value	i32 -> (2 words)	6064
S-0-0040, Velocity feedback value	i32 -> (2 words)	606C
S-0-0390, Diagnostic message number	u16-> (1 word)	5FF6

Real time data channel sequence:

	Word1	Word2	Word3	Word4	Word5	Word6
Master → Slave	P-0-4088	S-0-0258, H	S-0-0258, L	S-0-0259, H	S-0-0259, L	P-0-4076
Slave → Master	P-0-4089	S-0-0051, H	S-0-0051, L	S-0-0040, H	S-0-0040, L	S-0-0390

Fig. 5-5: Real time data channel contents

Note: When communicating via CANopen, 4 byte values are transmitted, in contrast to above in Intel format!

Structure of the fieldbus control and status words

Structure of P-0-4077, Fieldbus control word (P-0-4084 =0x0001)

In **P-0-4077**, **Fieldbus control word** (Object 6040) the control signals are transmitted from master to drive.

Control word for target position setting

Bit	Name	Definition
0	switch on	Drivecom control bit*
1	lock voltage	Drivecom control bit*
2	quick stop	Drivecom control bit*
3	ready enabled	Drivecom control bit*
4	new command value	rising edge (0-> 1): • new position command/speed transmitted to drive Bit new command value may only be set if the bit, "Command acknowledge" =0.
5	Change block immediately	Bit = 0: • positioning in progress may not be interrupted • bit „command acknowledge“ is set until target position is reached Bit = 1: • positioning in progress may be interrupted • bit „command value acknowledge“ is immediately reset as bit „new command“ is reset
6	setting command value abs / rel	Bit = 0: setting a relative target position (travel path) Bit = 1: setting an absolute target position the setting can be changed each time the command value is changed
7	reset fault	rising edge (0-> 1): clear errors (or message bit) if error no longer pending
8	jog forwards	Bit = 1: drive moved forward (Jog+) if status machine is in "enable" (**P-0-4056**, Bit0)
9	jog backwards	Bit = 1: drive moved backward (Jog+) if status machine is in "enable"(**P-0-4056**, Bit1)
10-13	reserved	---
14	Synchronous start	Bit = 1: start positioning
15	Start referencing	rising edge (0-> 1): • Start referencing command (**S-0-0148**=11b) Neither move to target nor jogging may be activated at this time (synchronous start = 0).

Fig. 5-6: Structure of P-0-4077, Fieldbus control word (Object 6040)

* The definition of these bits are displayed in the status machine.

Note: If the drive is to be moved with **P-0-4030, Jog velocity** over both inputs bit 8 or bit 9, then make sure that no referencing cycle or target positioning have been activated (synchronous start=0).

Structure of P-0-4078, Fieldbus status word (P-0-4084 =0x0001)

In **P-0-4078, Fieldbus status word** the master is updated on status information. The status includes, in addition to the Drivecom status machine, information about the error status of the drive as well as block processing.

Status word for target position setting

Bit	Name	Definition
0	ready	status bit of status machine*
1	ready	status bit of status machine*
2	ready enabled	status bit of status machine*
3	fault	this bit is set if drive error occurs (**S-0-0135**, Bit13)
4	voltage locked	status bit of status machine*
5	quick stop	status bit of status machine*
6	on lock	status bit of status machine*
7	warning	Bit = 1, if power off prewarning is pending (**S-0-0135**, Bit12)
8	message	Bit = 1, if power off prewarning is pending (**S-0-0135**, Bit11).
9	remote	Bit = 1: • fieldbus communications in phase 4 in progress This bit tells the master that the drive can be controlled by the master.
10	command value reached	Bit = 1: • axis at target position (**S-0-0013**, Bit12).
11	reserved	---
12	command value acknowledge	This bit set as acknowledge if bit "new command value" is set. Differentiation in terms of: • block immediate change = 0 command value acknowledge not reset until command position reached • block immediate change = 1 command value acknowledge removed directly upon acceptance by drive but after "new command value" bit is reset by master
13	reserved	---
14	reserved	---
15	drive referenced	Bit = 1, if drive is in reference (home found!) (**S-0-0403**, Bit0)

* The definition of these bits is displayed in status machine in Fig.:4-4.

Fig. 5-7: Structure of P-0-4078, fieldbus status word

DRIVECOM Status Machine

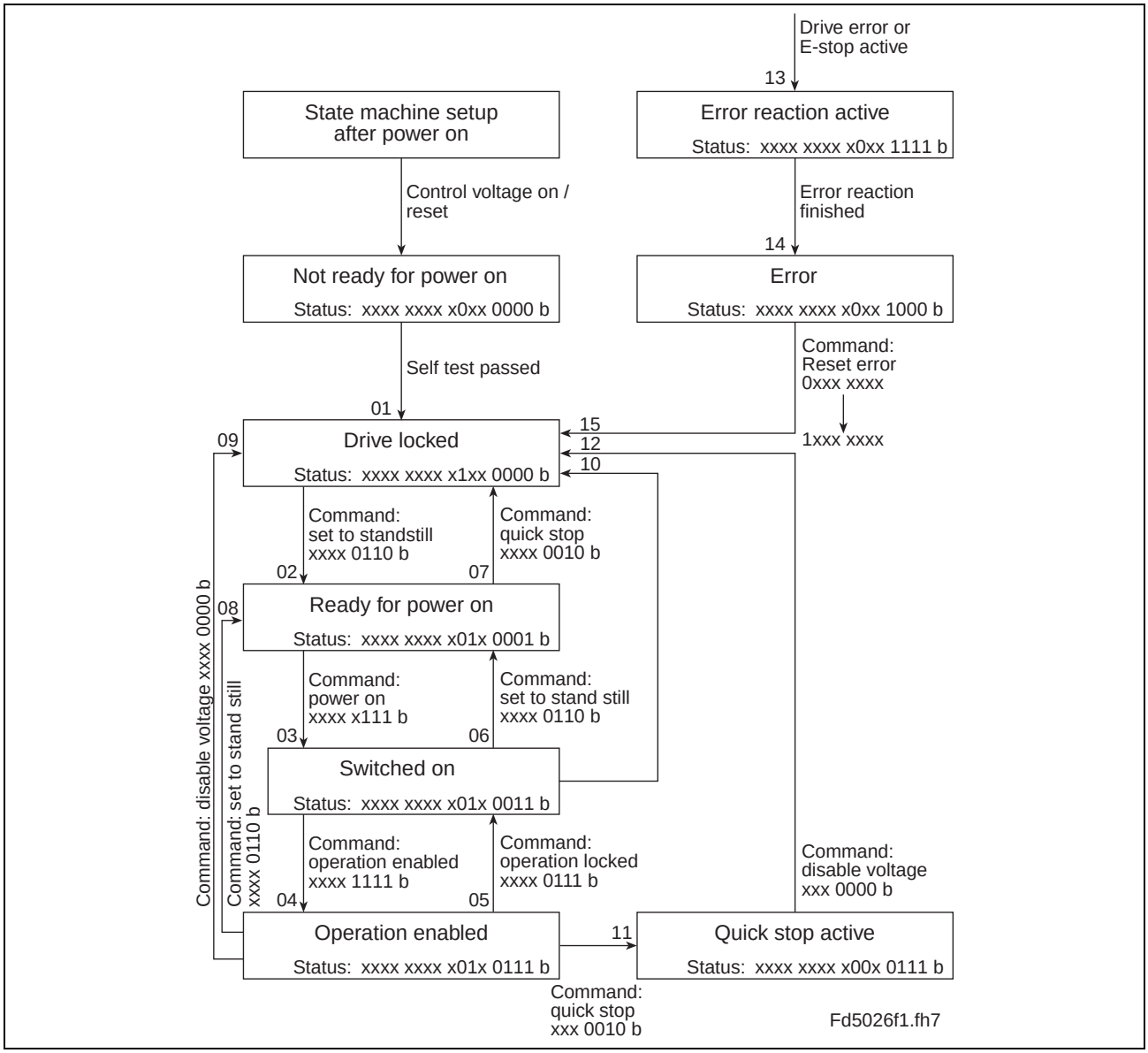


Fig. 5-1: Structure of Drivecom status machine

Control and status bits of status machine

The status machine is controlled via bits 0 to 3 of parameter **P-0-4077, Fieldbus control word** (Object 6040).

- switch on (**P-0-4077**, Bit0)
- lock voltage (**P-0-4077**, Bit1)
- quick stop (**P-0-4077**, Bit2)
- ready enabled (**P-0-4077**, Bit3)

The status of the status machine can be read in bits 0..6 of parameter **P-0-4078, Fieldbus status word** (object 6041).

- ready for switch on (**P-0-4078**, Bit0)
- switched on (**P-0-4078**, Bit1)
- ready to operate (**P-0-4078**, Bit2)
- fault (**P-0-4078**, Bit3)
- voltage locked (**P-0-4078**, Bit4)

- quick stop (**P-0-4078**, Bit5)
- lock on (**P-0-4078**, Bit6)

Note: Parameter settings and operating states are checked in the relevant transitions from one state to the other.

Running up the status machine

To bring the drive from basic state to "AH" or "AF" (running up status machine), three sequential commands are needed:

- standstill (bringing into state „ready for switch on“)
- switch on (bringing into state „switched on“)
- ready enabled (bringing into state „ready to operate“)

"Lock on" or "Basic state"
→ Display: "Ab" or "bb"

Directly after the control voltage of the machine is applied and the drive is internally brought up into phase 4:

- the parameters and settings are checked in terms of what is called for in **P-0-4084, profile type**
- and the fieldbus interface is configured.

Given a successful check, the drive is brought up into phase 4 and "Basic state" of the status machine is established.

"Lock on / Basic state" must be signalled:

P-0-4078 = xxxx xxxx x1xx 0000 b

„Ready for switch on“
→ Display: "Ab" or "bb"

To bring the machine into „ready for switch on“ it is necessary to first conduct the command „Standstill“ (**P-0-4077** = xxxx xxxx xxxx 0110 b).

A successful execution hereof is signalled with **„ready for switch on“**

P-0-4078 = xxxx xxxx x01x 0001 b.

“Switched on“
→ Display: "Ab" or "bb"

To bring into state „switched on“ it is necessary to first conduct the command „switch on“ (**P-0-4077** = xxxx xxxx xxxx 0111 b).

The execution is acknowledged with:

- power on („Ab“) with status „switched on“

  P-0-4078 = xxxx xxxx x01x 0011 b
- with power off („bb“) appears with status „ready for switch on“

  P-0-4078 = xxxx xxxx x01x 0001 b**.**

„Ready to operate“
→ Display: "AH" or "AF"

To bring into state „ready to operate“ it is necessary to first conduct the command „ready enabled“

P-0-4077 = xxxx xxxx xxxx 0111 b

is conducted with power on ("Ab").

The successful execution is signalled with status „ready to operate“

P-0-4078 = xxxx xxxx x01x 0111 b**.**

If the drive is in state „ready to operate“, then target position settings per Drivecom with

- **S-0-0258, Target position** (Object 607A)
- **S-0-0259**, **Positioning Velocity** (Object 6081)

are possible.

Bringing down the status machine

From status ready to operate it is possible to bring the drive back into basic state / lock on. This can be done in several different ways.

Bringing into state "quick stop active"

→ Display: "AH"

Bringing into state „quick stop active“ necessitates the execution of the „quick stop“ command

P-0-4077 = xxxx xxxx xxxx 0010 b

with power on ("Ab").

A successful execution is signalled with status „quick stop active“

P-0-4078 = xxxx xxxx x00x 0111 b**.**

Bringing into "Basic state / lock voltage"

→ Display: "Ab", or "bb"

To bring into „basic state“ command „lock voltage“

P-0-4077 = xxxx xxxx xxxx 0000 b

must be executed

A successful execution is signalled with status „Basic state“

P-0-4078 = xxxx xxxx x1xx 0000 b**.**

Other options of bringing the status machine down are:

- **P-0-4077** = xxxx xxxx xxxx 0111 b "lock operation"
- **P-0-4077** = xxxx xxxx xxxx 0110 b "standstill"
- **P-0-4077** = xxxx xxxx xxxx 0010 b "quick stop"

Status machine behavior given an error

Drive error

- of the C1D type
- or interface errors (e.g., E-stop)

bring the status machine into state:

P-0-4078 = xxxx xxxx x0xx 1111 b "error reaction active"

The drive is brought to a standstill in this state and after the parametrized error reaction (**P-0-0119**) has been completed, the status machine is brought into state

P-0-4078 = xxxx xxxx x0xx 1000 b "fault".

Clear error

The command activated via edge transition

P-0-4077 = xxxx xxxx 1xxxx xxxx b "Reset fault"

brings the drive into "Basic state".

Functional Principle of the Target position setting

Data handshake

A data handshake must always follow the following sequence:

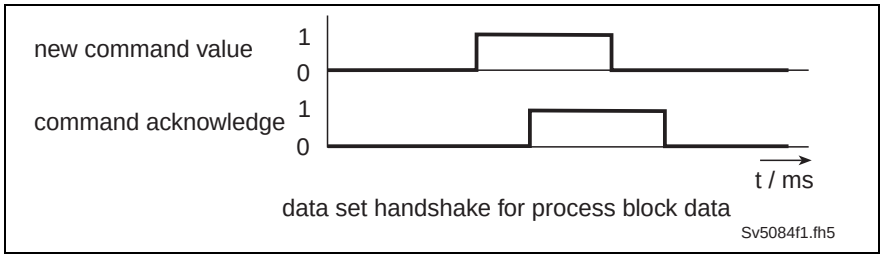


Fig. 5-2: Data handshake when accepting the target position block data

Control signals (bits)

The following signals are in the fieldbus control word to set target position block data and and to start the position target block:

- new command value (**P-0-4077, Fieldbus control word** Bit 4)
- change block immediately (**P-0-4077, Fieldbus control word** Bit 5)
- synchronous start (**P-0-4077, Fieldbus control word** Bit 14)

Change block immediately (Bit5)

In conjunction with signal "change block immediately" the user can decide whether a target position block should first be completely processed before a new block may be set or if such a setting (overwrite capability) is possible before hand.

Change block immediately = 0

If the signal change block immediately is not set in the fieldbus control word, then a target position block set with the signal "new command value" is completed before a new one can be set or the old can be overwritten.

The position target block is started with signal "synchronous start**" (**Bit14 of **P-0-4076, Fieldbus container object**). This signal can be reset at any time to interrupt a travel cycle and can then be reset.

Upon reaching the target position (**S-0-0013, Class 3 diagnostics** Bit 12=1)

- if Bit 10, "command value reached" has been set in the fieldbus status word
- and then bit 12, "command value acknowledge" is reset in the fieldbus status word.

Note: Not until the command value acknowledge is reset can a new target position block be set!

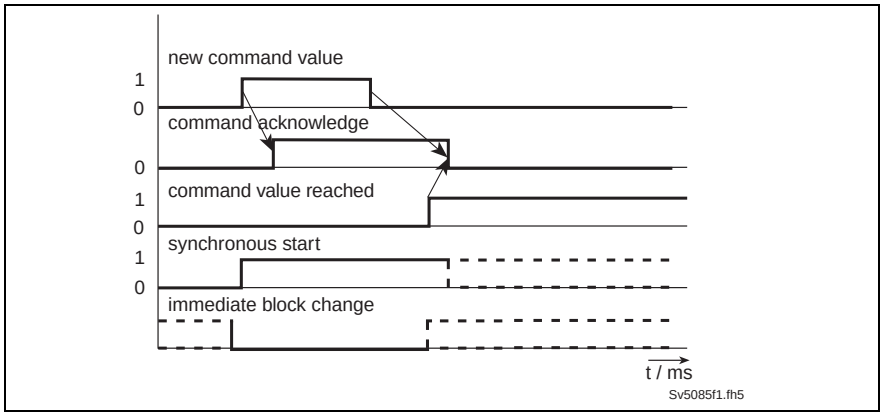


Fig. 5-3: Chronological sequence of signals "change block immediately "= 0

Change block immediately = 1

If signal "change block immediately" is set, then a specific change in

- target position and/or
- traversing speed

is possible at any time.

If bit 5 "change block immediately" is set in the fieldbus control word, then, after a target position setting

- the signal "command value acknowledge" is set in the fieldbus status word with signal "new command value"
- and after the signal "new command value" is reset by the master, the signal "command value acknowledge" is immediately reset.

It is now possible to set target position data at any time.

Note: If bit5 "change block immediately" is reset again before the positioning procedure is completed ("command value reached" = 0), then the signal "command value acknowledge" in the fieldbus status word is reactivated. A new target position setting will then not be possible until the command position has been reached.

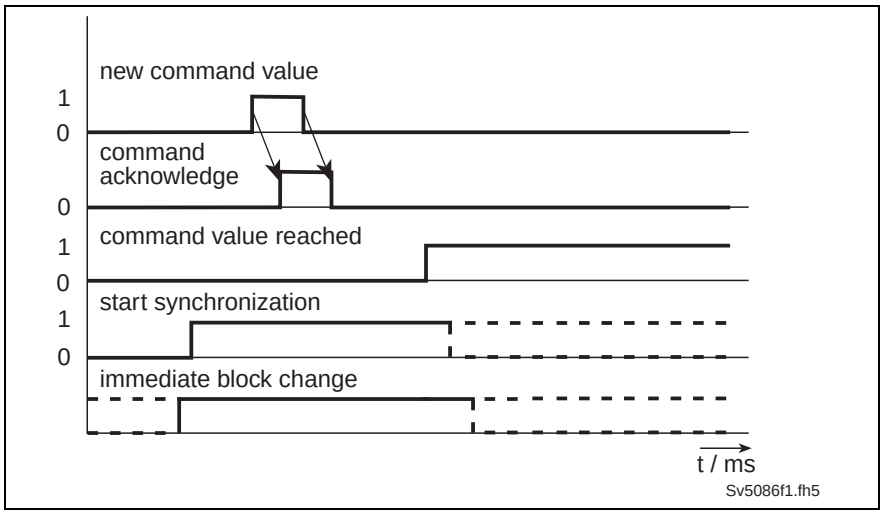


Fig. 5-4: Chronological sequence of signal "change block immediately "= 1

Terminating a positioning in progress

If the target position setting is done without "change block immediately" (Bit5=0), then, as described above, new target position data cannot be set until the block in progress has been completed.

External events can force the termination of a positioning in progress. It can hereby be necessary to set new position target data (target position or speed).

There are two different reasons that a positioning procedure can be terminated:

- termination without a new target position setting
- termination with new target position setting

Interrupting with "synchronous start"

Independent of this, a positioning in progress can be interrupted by removing the "synchronous start" signal in the fieldbus control word.

Once the signal "synchronous start" is reset again, block processing continues, block data are retained.

Terminating with "change block immediately"

without new target position data

By setting the signal "change block immediately"

- the positioning in progress is terminated (drive halt)
- the present actual position is used as position command value(**S-0-0258, Target position = S-0-0051, Position feedback 1 value**) as soon as the actual velocity is **S-0-0040** = 0!
- the signal "command value acknowledge" (bit 12 of **P-0-4078, Fieldbus status word**) is reset
- the signal "command value reached" (Bit 10 of **P-0-4078, Fieldbus status word**) is set

After the signal "command value acknowledge" is reset in the fieldbus status word, then the signal "change block immediately" can be reset again.

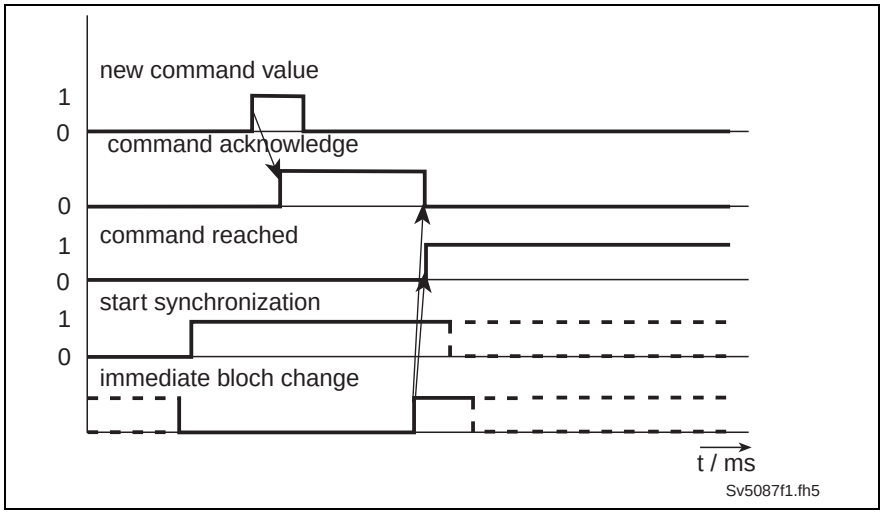


Fig. 5-5: Chronological sequence of signals with termination of positioning in progress without new target position setting

Termination with "change block immediately"

with new target position data

Using the signal "change block immediately", new target position data can be set. In this case, the current target position data is replaced with new data. If the new data has the same rotational direction as the old, then positioning is continued with a break but with new target position data.

If position data with opposite rotational directions are set, then the positioning in progress is terminated and processing completed with the new position data.

By setting signal "change block immediately"

- positioning in progress can be terminated
- new target position data can be set in the drive
- and signal "command value acknowledge" (Bit 12 of **P-0-4078, fieldbus status word**) can be reset.

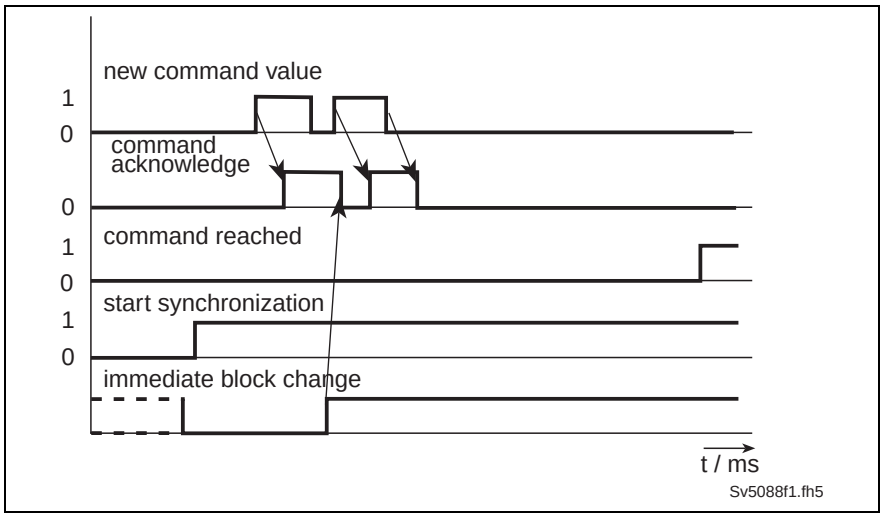


Fig. 5-6: Chronological sequence of signals when terminating a positioning in progress with a new target position setting

Processing relative target positions:

To retain the sequential reference, the relative target positions relate to

- the last target position with message "INPOS" and
- the current actual position with no message "INPOS".

5.4 Speed control 2 (P-0-4084= 0x0003)

Features

- By selecting profile type speed control 2 (similar to Drivecom profile 22), the digital drive controller is placed under the control of a status machine which checks the internal states of the drive and generates the fieldbus status word.
- Using a control word, the status machine can set the sequence which takes the drive from its basic state (no drive enable) to drive enable "AF".
- The main operating mode speed control with filter and ramp is set.
  See also: "Operating mode: speed control"
- The 1st auxiliary mode is **jogging.**
  Also see: Operating mode: jogging".
- **P-0-4077, Fieldbus control word** (object 6040) contains the structure defined with profile 22.
- **P-0-4078, Fieldbus status word** (object 6041) contains the structure defined with profile 22.
- The entire contents of the real time data channel and the structure of the fieldbus control and status words are fixed by what is set in **P-0-4084, profile type**.
- The parameter channel can be expanded to six words in the case of Profibus-DP with the use of **P-0-4083**! (Default: P-0-4083 = 0 → without parameter channel)!
- The length of the cyclical data channel is fixed with: **P-0-4082** = **P-0-4087** = 12 bytes + **P-0-4083**

Structure of the Real Time Data Channel

Master → Slave

In the real time channel of the fieldbus, the data in **P-0-4081, Process data output description** is transmitted from master to drive.

Parameter	Format	Object
P-0-4077, Fieldbus control word	i16 -> (1 word)	6040
S-0-0036, Velocity command value	i32 -> (2 words)	607C
*** P-0-4076, Fieldbus container object**	i16 -> (1 word)	5FF1
*** P-0-4076, Fieldbus container object**	i16 -> (1 word)	5FF1
*** P-0-4076, Fieldbus container object**	i16 -> (1 word)	5FF1

*These parameters are only needed with Interbus.

Note: Filling up with dummies is only necessary with an Interbus S due to the bus structure.

Slave → Master

In the real time channel of the fieldbus, the data set in **P-0-4080, Process data input description** are transmitted from master to the drive.

Parameter	Format	Object
P-0-4078, Fieldbus status word	i16 -> (1 word)	6041
S-0-0040, Velocity feedback value	i32 -> (2 words)	606C
S-0-0390, Diagnostic message number	u16-> (1 word)	5FF6
S-0-0051, Position feedback 1 value	i32 -> (2 words)	6064

Real time data channel sequence:

	Word1	Word 2	Word 3	Word4	Word5	Word6
Master → Slave	**P-0-4077**	**S-0-0036**,H	**S-0-0036**,L	**P-0-4076**	**P-0-4076**	**P-0-4076**
Slave → Master	**P-0-4078**	**S-0-0040**,H	**S-0-0040**,L	**S-0-0390**	**S-0-0051**,H	**S-0-0051**,L

Fig. 5-7: Contents of the real time channel

Note: When communicating via CANopen, four byte values, in contrast to above, are transmitted in Intel format!

Structure of the Fieldbus Control and Status Words

Structure of P-0-4077, Fieldbus control word (P-0-4084 =0x0003)

Control word for speed control 2

The control signals are transmitted from master to drive in **P-0-4077, Fieldbus control word.**

Bit	Name	Definition
0	switch on	Drivecom control bit*
1	lock voltage	Drivecom control bit*
2	quick stop	Drivecom control bit*
3	ready enabled	Drivecom control bit*
4-6	*reserved*	--
7	reset fault	rising edge (0-> 1): Clear errors (or message bits) if error no longer pending.
8	jog forwards	Bit = 1: drive moving forward (Jog+) if status machine in state "Enabled".
9	jog backwards	Bit = 1: drive moving backwards (Jog-) if status machine in state "Enabled".
10-13	*reserved*	---
14	synchronous start	Bit = 1: drive follows speed command value (Display: "AF") Bit = 0: drive halt (Display: "AH")
15	start referencing	rising edge (0-> 1): • Start referencing command (**S-0-0148**=11b) No target position move (synchronous start = 0) or jog command may be activated at this time.

Fig. 5-8: Structure of **P-0-4077, Fieldbus control word**

* The definition of these bits is diplayed in the status machine.

Note: If the drive is to move with **P-0-4030**, **Jog velocity** over both inputs bit8 or bit9 then make sure that no referencing cycle is active and there is no target positioning pending (synchronous start = 0).

Structure of P-0-4078, Fieldbus status word (P-0-4084 =0x0003)

Status word for speed control 2

In **P-0-4078, Fieldbus status word** the master receives the current status information. The status includes the state of the Drivecom status machine and information about the error status of the drive as well as command value processing.

Bit	Name	Definition
0	ready for switch on	status bit of status machine*
1	switched on	status bit of status machine*
2	ready to operate	status bit of status machine*
3	fault	This bit is set if a drive error occurs (**S-0-0135**, Bit13)
4	voltage locked	status bit of status machine*
5	quick stop	status bit of status machine*
6	on lock	status bit of status machine*
7	warning	Bit = 1, if an off prewarning is pending (**S-0-0135**, Bit12)
8	message	Bit = 1, if a message is pending (**S-0-0135**, Bit11).
9	remote	Bit = 1: • running fieldbus communication in phase 4 This bit tells the master that it can control the drive.
10	command value reached	Bit = 1: (**S-0-0013**, Bit0). • actual speed value has reached speed command (**S-0-0040 = S-0-0036)**
11	*reserved*	---
12	speed = 0	Bit=1: Actual speed value within parameter **S-0-0124, Standstill window**
13,14	*reserved*	---
15	drive referenced	Bit = 1 if drive is referenced (home established) (**S-0-0403**, Bit0)

Fig. 5-9: Structure of P-0-4078, fieldbus status word

* The definition of these bits is displayed in status machine Fig.:4-4.

5.5 Drive-internal interpolation

Features

- (P-0-4084= 0xFF91) The main operating mode drive-internal interpolation is set. Also see: Operating mode: drive-internal interpolation".
- The 1st auxiliary mode is set to jogging.
- The fieldbus cyclically transmits **S-0-0258, target position** and **S-0-0259, Positioning speed.**
- The entire contents of the real time data channel and the fieldbus control and status word structure is fixed with what is set in **P-0-4084, Profile type**.
- Indramat-specific structure of **P-0-4077**, **Fieldbus control word** and **P-0-4078, Fieldbus status word**.
- Length of cyclical data channel fixed with:
  P-0-4082 = **P-0-4087** = 12 bytes + **P-0-4083**
- the parameter channel can be expanded with six words in the Profibus-DP using **P-0-4083**! (Default: **P-0-4083** = 0 → without parameter channel)!

Structure of the Real Time Data Channel

This preconfigures all command and actual values in lists **P-0-4080** and **P-0-4081** needed for positioning.

Structure of Fieldbus Control and Status Words

Structure of **P-0-4077, Fieldbus control word (P-0-4084 =0xFF91).**

The structure corresponds to the control word of the configurable mode (see profile type **P-0-4084**=0xFFFE).

Structure of **P-0-4078, Fieldbus status word (P-0-4084 =0xFF91)**

The structure corresponds to the control word of the configurable mode (see profile type **P-0-4084**=0xFFFE)

5.6 Cyclical Position Control (P-0-4084= 0xFF92)

Features

- The main operating mode cyclical position control is set.
- Using the fieldbus, the parameter **S-0-0047, Position command value** is transmitted. The command value processing within the drive is synchronized to the synchronization telegram of the fieldbus.
- The 1st auxiliary mode is jogging.
- The entire contents of the real time data channel and the fieldbus control and status word structure is fixed with what is set in **P-0-4084, profile type**.
- Indramat-specific structure of **P-0-4077, Fieldbus control word** and **P-0-4078, fieldbus status word.**
- Length of cyclical data channel fixed with:
  P-0-4082 = **P-0-4087** = 8 bytes + **P-0-4083**

Structure of the Real Time Data Channel

Master → Slave

The data configured in **P-0-4081, Real-time output object structure** is transmitted from the master to the drive in the real time channel of the fieldbus.

Parameter	Format	Object
P-0-4077, Fieldbus control word	i16 -> (1 word)	6040
S-0-0047, Position command value	i32 -> (2 words)	607C
P-0-4076, Fieldbus container object	i16 (1 word)	5771

Slave → Master

The data configured in **P-0-4080, Process data input description** is transmitted from master to the drive in the real time channel of the fieldbus.

Parameter	Format	Object
P-0-4078, Fieldbus status word	i16 -> (1 word)	6041
S-0-0051, Position feedback 1 value	i32 -> (2 words)	6064
S-0-0390, Diagnosis message number	u16-> (1 word)	5FF6

Real time data channel sequence:

	Word1	Word2	Word3	Word4
Master → Slave	**P-0-4077**	**S-0-0047**,H	**S-0-0047**,L	**P-0-4076**
Slave → Master	**P-0-4078**	**S-0-0051**,H	**S-0-0051**,L	**S-0-0390**

Fig. 5-10: Contents of the real time channel

Note: When communicating via CANopen, four byte values, in contrast to above, are transmitted in Intel format!

Structure of the Fieldbus Control and Status Words

Structure of P-0-4077, Fieldbus control word (P-0-4084 =0xFF92)

The structure corresponds to the control word of the freely configurable mode (profile type**P-0-4084**=0xFFFE**)**

Structure of **P-0-4078, Fieldbus status word** (**P-0-4084** =0xFF92)

The structure corresponds to the status word of the freely configurable mode (profile type **P-0-4084**=0xFFFE).

5.7 Profile Type, Speed Control

Features

- (P-0-4084= 0xFF93) The main operating mode velocity control with filter and ramp is set.

  See also: Operating Mode: Velocity Control"
- The 1st auxiliary mode is jogging.
  See also chapter: "Operating Mode: Jogging"

- Cyclical velocity command and actual values are transmitted via the fieldbus.
- No profile interpreter and thus no status machine is active!
- The entire contents of the real time data channel and the fieldbus control and status word structure is fixed with what is set in **P-0-4084, profile type**.
- Indramat-specific structure of **P-0-4077, Fieldbus control word** and **P-0-4078, fieldbus status word.**
- The parameter channel in Profibus-DP can be expanded to six words with **P-0-4083**! (Default: **P-0-4083** = 0 → without parameter channel)!
- Length of cyclical data channel fixed with:
  P-0-4082 = **P-0-4087** = 8 bytes + **P-0-4083**

Structure of Real Time Data Channel

The structure of the real time channel corresponds to section 4.4. This preconfigures all real time data needed for speed control in configuration list **P-0-4080** or **P-0-4081**.

Structure of the Fieldbus Control and Status Words

Structure of P-0-4077, Fieldbus control word (P-0-4084 =0xFF93)

The structure corresponds to the control word of the freely configurable mode (see profile type **P-0-4084**=0xFFFE).

Structure of P-0-4078, Fieldbus status word (P-0-4084 =0xFF93)

The structure corresponds to the status word of the freely configurable mode (see profile type **P-0-4084**=0xFFFE).

5.8 Freely configurable operating mode (P-0-4084=0xFFFE)

Operating with analog command values (Fieldbus not active)

Features

- In this operating mode it is possible to run with analog or torque command values.
- The control of the drive enable or of drive halt is not done via the fieldbus but rather through hardware inputs (X1 pin3, pin4) until fieldbus communications is not active (bus connector pulsed).

Parametrization

To parametrize an analog operation:

- set profile type to freely configurable mode (**P-0-4084**=0xFFFE)
- set main operating mode to speed control with filter and ramp (**S-0-0032** = 10b)
  Also see: "Operating mode: speed control".
- Configure velocity command value at analog input 1 (**P-0-0213** = **S-0-0036**)
- Set relevant evaluation of analog input via **P-0-0214**
- If necessary, change the configuration lists **P-0-4080, P-0-4081** and so on.

Operating via Fieldbus Interface (Fieldbus active)

Features

- The contents of the real time data channel must be configured via **P-0-4080** and **P-0-4081**.
- Indramat-specific structure of **P-0-4077**, **Fieldbus control word** and **P-0-4078**, **fieldbus status word.**
- Enables the use of all drive functionalities.
- Main and auxiliary operating modes can be set.

Structure of the real time data channel

Note: P-0-4077, Fieldbus control word and P-0-4078, Fieldbus status word are always transmitted.

Master → Slave

The data configured in **P-0-4081, Process data output description** is transmitted from master to drive in the real time channel of the fieldbus.

Parameter	Format	Object
P-0-4077, **Fieldbus control word**	i16 -> (1 word)	6040
other command values	:	

Slave → Master

The data configured in **P-0-4080, Process data input description** are transmitted from master to the drive in the real time channel of the fieldbus.

Parameter	Format	Object
P-0-4078, **fieldbus status word**	i16 -> (1 word)	6041
additional actual values	:	

Real time data channel sequence:

	Word1	Word2	...	word n
Master → Slave	**P-0-4077**	command value 1		
Slave → Master	**P-0-4078**	command value 1		

Fig. 5-11: Contents of the real time channel

Note: When communicating via CANopen, four byte values, in contrast to above, are transmitted in Intel format!

Control word for freely configurable mode

Structure of P-0-4077, Fieldbus control word (P-0-4084 =0xFFFE)

Bit	Name	Definition
0	command value assumption	When change positioning block activated (**P-0-0346**, Bit0)
1	operating mode-setting	0->1: operating mode 1->0: parametrization mode
2	homing	0->1: start referencing command "C6" (**S-0-0148**=11b) 1->0: end reference command "C6" (**S-0-0148**= 0b)
3,4	*reserved*	--
5	clear error	0->1: start clear error command "C5" 1->0: end command "C5"
6 **7**	jog forwards jog backwards	1: jog forwards (**P-0-4056**, Bit0=1) 1: jog backwards (**P-0-4056**, Bit1=1)
8, 9*	Command operating mode	00: main operating mode (S-0-0134, Bit 8,9) 01: 1st auxiliary mode (e.g., jogging) 10: 2nd auxiliary mode 11: 3rd auxiliary mode
10,11*	reserved	--
12*	IPOSYNC	Interpolator cycle: toggles if new command value transmitted
13*	drive halt	1->0 edge brings drive to standstill (**S-0-0134**, Bit 13)
14*	drive enable	1->0 edge brings torque immedaitely to zero (**S-0-0134**, Bit 14)
15*	drive ON	1->0 edge conducts best possible standstill as per **P-0-0119** (**S-0-0134**, Bit 15)

* The structure same as contents of S-0-0134.

Fig. 5-12: Structure of P-0-4077, Fieldbus control word.

Structure of P-0-4078, Fieldbus status word (P-0-4084 =0xFFFE)

Status word for freely configurable mode

Bit	Name	Definition
0,1	operating mode acknoweldge	10: Phase 4 (operating mode) 01: Phase 3 00: Phase 2 (parametrization mode)
2	in reference	1: drive is referenced (**S-0-0403**, Bit0)
3	at standstill	1: drive standing (**S-0-0013**, Bit1)
4	In position	1: target position reached (**S-0-0182**, Bit10)
5	change bit command	1: if command status has changed 0: if command status has not changed
6	operating mode error	1: error in transition command 0: no error in transition command
7	drive halt	1: drive halt active 0: drive halt not active
8, 9	actual operating mode	00: main operating mode 01: 1st auxiliary mode (e.g., jogging) 10: 2nd auxiliary mode 11: 3rd auxiliary mode (**S-0-0135**, Bit 8,9)
10*	reserved	--
11	message ZKL3*	This bit is set if a message of C3D is pending.
12	warning ZKL2*	This bit is set if a C2D warning is pending.
13	drive error ZKL1*	This bit is set if a C1D error is pending (drive lock). (**S-0-0135,** Bit 13)
14, 15	ready	00: not ready for power 01: ready for power 10: control and power sections ready and torque free 11: in operation, with torque (**S-0-0135,** Bit 15)

* The structure is the same as contents of S-0-0135.

Fig. 5-13: Structure of P-0-4078, Fieldbus status word

*) ZKL1: class 1 diagnostics (C1D)
ZKL2: class 2 diagnostics (C2D)
ZKL3: class 3 diagnostics (C3D)

6 Motor Configuration

6.1 Characteristics of the Different Motor Types

You can use the following motor types.

- MKD
- 2AD
- 1MB
- LAF
- MKE
- Rotary synchron kit motor
- MHD
- ADF
- MBW
- LAR
- Linear synchron kit motor

The individual motor types differ in the following points:

- Availability of data memory in the motor feedback for all motorspecific parameters
- Synchronous motor - Asynchronous motor
- Linear motor - rotational motor
- Temperature check can be changed or not.
- Basic load (load default) is possible when a Feedback-Data Memory is

  present.
- Motor encoder interface setting can be changed or one setting only
- Start of commutation offset setting command possible or not
- Motor temperature sensor with PTC or NTC features

The individual motor types have the following characteristics

Motor type	Motor feedback data memory	Sync./Async.	Temp. check	Motor-encoder interface	Load default	Temp. Sensor
MHD/MKD/MKE	yes	synchronous	fixed	fixed (1)	possible	PTC
2AD/ADF	no	asynchronous	param.	param.	no	NTC
1MB	no	asynchronous	param.	param.	no	NTC
LAF/LAR	no	asynchronous	param.	param.	no	PTC
LSF	no	synchronous	param.	fixed (8)	no	PTC
2AD with PTC	no	asynchronous	param.	param.	no	PTC
MBS	no	synchronous	param.	param.	no	PTC

Fig. 6-1: Characteristics of the Motor Types part 1

Motor Feedback-Data Memory

The motor feedback data memory contains all motor-related parameters

For MHD, MKD and MKE motors, a motor feedback-data memory is provided, in which all motor-dependent parameters are stored. The drive controller recognizes this automatically and reads those parameters after turning on the device from the data memory with the command **S-0-0128, C200 Communication phase 4 transition check**.

The data memory contains values for the following parameters:

- **S-0-0109, Motor peak current**
- **S-0-0111, Motor current at standstill**
- **S-0-0113, Maximum motor speed (nmax)**
- **S-0-0141, Motor type**
- **P-0-0018, Number of Pole Pairs/Pole Pair**
- **P-0-0051, Torque/Force constant**
- **P-0-0510, Moment of inertia of the rotor**
- **P-0-0511, Brake current**

Note: Motor types without motor feedback memory necessitate that these parameters are input with initial start-ups using the data sheet.

Linear-Rotational

units / motors

Depending on whether a linear or rotary motor is being used, changes in the units and the number of decimal places will be made by the parameters. The following table displays the differences in scaling of these parameters:

ID number:	Rotational:	Linear:
S-0-0100	0,1 As/rad	0,1As/m
S-0-0113	0,0001 RPM	0,0001 mm/min
S-0-0116	Cycles/Rev.	0.00001 mm
P-0-0018	Pole pairs	0,1mm
P-0-0051	Nm/A	N/A
S-0-0348	mAs²/rad	mAs²/mm

Fig. 6-2: Scaling in Linear or Rotary Motors

The selected motor type also affects the scaling of the position data.

For example, it is impossible to set rotary motor settings for linear motors and linear motor settings for rotary motors. This would generate the command error **C213 Position data scaling error** during a phase progression.

Synchronous-Asynchronous

Specific parameters are used only for synchronous motors, others only for asynchronous motors.

There are differences in the use and review of the parameters in the command **S-0-0128, C200 Communication phase 4 transition check**.

They are:

Synchronous:

- **P-0-4004, Magnetizing current** is set to 0
- **P-0-0508, Commutation offset** is checked for validity

Asynchronous:

- **P-0-4004, Magnetizing current** is initialized
- **P-0-0508, Commutation offset** is not checked

Temperature Monitoring

The switch-off limit for the motor temperature check is fixed at one point for MHD-, MKD, MKE motors.

The following parameters are used to monitor the motor temperature:

S-0-0201, Motor warning temperature

S-0-0204, Motor shutdown temperature

For MHD, MKD and MKE motors, the parameter default values are:

S-0-0201, Motor warning temperature = 145,0°C

S-0-0204, Motor shutdown temperature = 155,0°C

Those default values can be used to help set the parameters for all other motor types. However, you must ensure that the switch-off limit is not set higher than the maximum permissible temperature of the motor.

The maximum input value for **S-0-0201, Motor warning temperature** is **S-0-0204, Motor shutdown temperature**.

If the temperature of the motor exceeds the value in **S-0-0201, Motor warning temperature**, the warning message **E251 Motor overtemp. prewarning** is generated.

If the temperature rises to the motor switch-off temperature, the error message **F219 Motor overtemp. shutdown** is displayed.

The minimum input value for **S-0-0204, Motor shutdown temperature** is **S-0-0201, Motor warning temperature**.

Note: To display the motor temperature, the parameter **S-0-0383, Motor Temperature is used.**

The drive controller checks for proper functioning of the motor temperature monitoring system. If discrepancies occur (temperature drops below -10 degrees), the warning **E221 Warning Motor temp. surveillance defective** will be displayed for 10 seconds. After that, the error message **F221 Error Motor temp. surveillance defective** is generated.

Load Default Feature

MHD, MKD and MKE motors have a data memory in their feedbacks. The data memory contains a set of default control parameters in addition to all motor-dependent parameters.

These parameters are activated with the load default feature.

(See also "Load Default"feature.)

6.2 Setting the Motor Type

The setting of the motor type is done either:

- it depends on the used motor type.
- automatically by reading the motor feedback memory, or
- through the input of the parameter **P-0-4014, Motor type.**

The motor type should be set before start up because the motor type affects the drive functions:

See also Chapter: "Characteristics of the Different Motor Types"

Automatic Setting of the Motor Type for Motors with Feedback Memory

MHD, MKD and MKE motors have a motor feedback data memory, in which the motor type is stored (along with other information). The drive controller recognizes these motor types automatically and the following is executed:

- the value of the parameter **P-0-4014, Motor type** is set to its proper value and will be write-protected.
- the value of the parameter **P-0-0074, Feedback 1 type** is set to the defined value for the corresponding motor type.
- all bits except bit 6 are set for absolute/not-absolute to "0" in the parameter **S-0-0277, Position feedback 1 type**.
- all motor-dependent parameters are read out of the motor feedback data storage (see Motor Feedback-Data Memory). The parameter in the motor feedback memory are set with parameter block number 7. These are fetched and copied into the relevant parameters with parameter block number 0.
- the value of **S-0-0201, Motor warning temperature** will be set to 145,0°C, and the **S-0-0204, Motor shutdown temperature** will be set to 155,0°C.
- The value of **P-0-0525, Type of motor brake** is set to "0". The value of **P-0-0526, Brake control delay** is set to 150 ms.

This procedure is followed right after switching on as in the command **S-0-0128, C200 Communication phase 4 transition check**. The command error message, **C204 Motor type P-0-4014 incorrect**, will be generated in case an MHD, MKD and MKE motor is selected in **P-0-4014, Motor type** but the corresponding character sequence cannot be found in the motor feedback data memory.

Setting of the Motor Type through P-0-4014, Motor Type

For motors without motor feedback data memory, you have to set the motor type through **P-0-4014, Motor type**.

See also: Characteristics of the Different Motor Types

6.3 Asynchronous Motors

With the Firmware, you can use asynchronous motors in the entire rpm range, including constant power range.

In addition to the general motor parameters, you have to set the following asynchronous motor parameters for specific motors according to the Indramat default:

- **P-0-4004, Magnetizing current**
- **P-0-4012, Slip factor**
- **P-0-0530, Slip Increase**
- **P-0-0531, Stall Current Limit**
- **P-0-0533, Flux Loop Prop. Gain**
- **P-0-0534, Flux Loop Integral Action Time**
- **P-0-0535, Motor voltage at no load**
- **P-0-0536, Motor voltage max.**

The user has one additional parameters to adjust the drive to his requirements.

- **P-0-0532, Premagnetization factor**

Basics for the Asynchronous Motor

Asynchronous motors are divided in three working ranges.

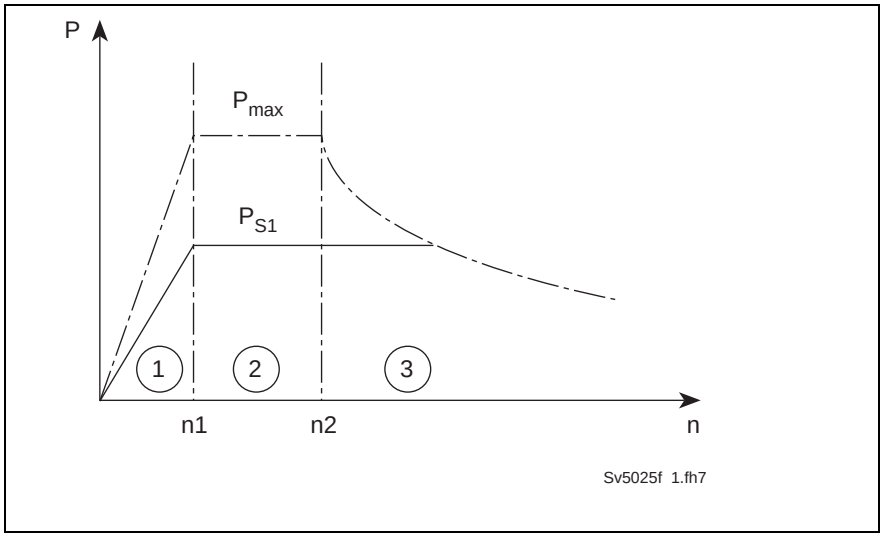


Fig. 6-3: Subsections of Work Ranges

Section 1:

The Basic RPM Range is defined by a constant torque and a fixed torque/force constant (parameter P-0-0051). In idle, the programmed magnetization current flows. The motor voltage is less than the maximum control output voltage. The corner RPM n1 is directly proportional to the DC bus voltage.

Section 2:

Range of Constant Power. The motor voltage is constant; the idle voltage and the corresponding magnetization and torque constants fall with increasing velocity. The slip is increased correspondingly.

The adjustment of magnetization current and slip is executed automatically by the vector control. The voltage is decreased during idle to the motor idle voltage (P-0-0535), and when fully in use it is increased to the maximum motor voltage (P-0-0536).

Section 3:

Range of decreasing Peak Power. The motor works at the sweep limit; an actual sweep is eliminated with the vector control. According to the parameter "sweep current limit," the peak current will be decreased enough so that the maximum power cannot be exceeded. An increase in current would lead only to wasted power and reduced shaft power. The peak power in range 3 is proportional to the square of the DC bus voltage. It is ensured that the maximum power always is reached for each DC bus voltage without parameter adjustment.

The power in range 3 cannot be extended through the use of more powerful controllers.

Torque Evaluation

100% torque refer to the motor's nominal torque according to the ID plate. Since the peak torque of asynchronous motors is limited to 2.5 times of the set value, you can reach torques up to 250%.

The significance of the torque values changes in the field-weakening range since the torque in the controller is set equal to the torque-producing current Iq. The torque, however, is the product of Iq and air gap induction, which decreases in the field-weakening range.

The assignment of the torque values in the different velocity ranges is displayed in the following picture:

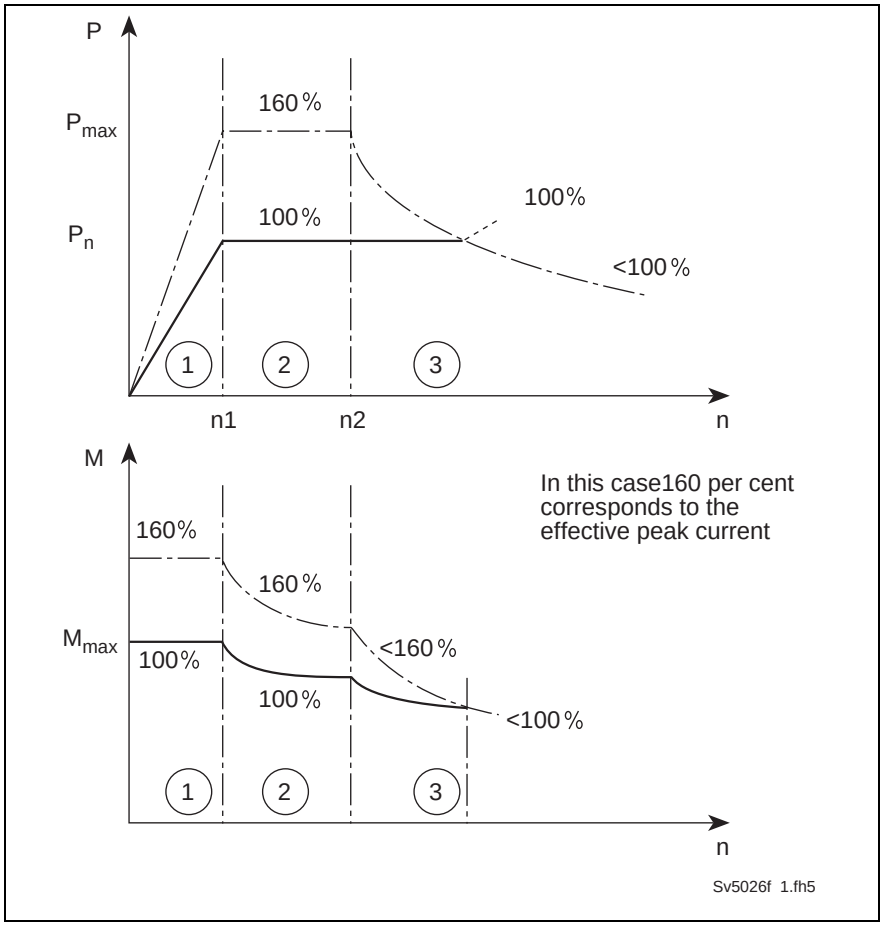


Fig. 6-4: Torque assignment

In range 1, the torque value is the actual torque. 100% = rated torque.

In range 2, the torque value is equal to the power.
100% = rated power according to selection list. (The rated power of the motor rating plate is not relevant here since it could relate to another DC bus voltage.) **Range 3** is similar to the evaluation of range 2, except that the preset torque decreases in correspondence to the increasing velocity of the peak power. For high velocity, the maximum torque value can drop below 100%.

In braking mode, you can reach 50% higher torque values in this range than in driving mode.

User-defined Settings for the Asynchronous Motor

To operate an asynchronous motor, you have to set the specific motor parameters in the controller. The Parameters are stored in the Parameterstorage and are therefore transferable to another controller.

Note: Motor-specific parameters are used by all controls in the same manner. The resulting power characteristics curve depends on the current and especially on the DC bus voltage. Several additional parameters are available so the user can optimize the drive to his requirements.

Scaling Factor Pre-Magnetizing

With **P-0-0532, Premagnetization factor** you can set the active magnetization current.

The following applies:

Effective magnetization current = magnetization voltage • scaling factor pre-magnetizing

Fig. 6-5: Calculation of the Effective Magnetization Current

If the pre-magnetizing scaling factor is at 100%, the motor is completely magnetized. There is a linear connection between set current and torque according to the torque constant P-0-0051. The torque builds up without delay. The drive has perfect servo properties.

The disadvantages are the high iron loss and the higher noise level in idle and in work mode, especially at 4kHz switching frequency, when the full magnetization current is flowing. For main spindle applications, it has proven successful to reduce the pre-magnetizing scaling factor to 50%. Through this procedure, the motor stays cooler and is not as noisy, while peak power is maintained. The extended start control time (only for jumps that exceed half the peak torque) and the missing linearity of torque and voltage do not distort the main spindle drives.

The qualitative connection between the pre-magnetizing scaling factor and drive behavior is displayed in the following graphic:

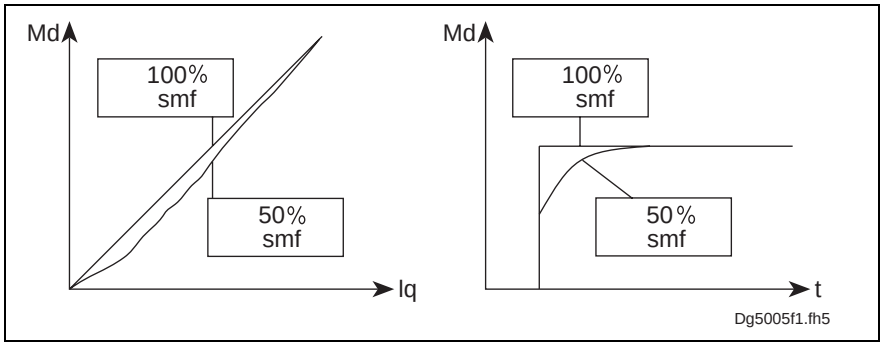


Fig. 6-6: Connection of pre-magnetizing scaling factor and drive behavior

The torque buildup is delayed by about 200ms during pre-magnetizing because the air gap range can only increase slowly in relation to the rotor time constant.

By reducing the pre-magnetizing scaling factor, you can achieve a better synchronous operation (in the one-thousandth degree range). This will reduce distorted torques, which result from saturation effects in the motor and from unavoidable deviations from an ideal sine form. To keep the torque linear in this case, the slip factor must be increased in the same measure at which the pre-magnetizing scaling factor was decreased. Warning: Torque constant, continual torque and peak torque are reduced!

Example: The synchronous operation should be improved in a servo drive. The pre-magnetizing scaling factor is set to 40%, and the slip factor is set to 2.5 times of the original value. The continual and peak torque decrease to approximately 40%. The reference speed increases to 2.5 times the velocity.

6.4 Synchronous Motors

With this drive firmware it is possible to operate not only Indramat motors with housing such as

- MHD and
- MKD and MKE motors

but also rotary and linear synchronous kit motors such as MBS and LSF. INDRAMAT motors with housing have a stator, rotor, bearings and feedback already built in. They have motor feedback memory in which

- motor parameters
- motor feedback parameters
- synchronous motor-specific parameters and
- default control parameters

are stored. This motors are recognized by the firmware and all settings automatically instituted. With these motors the alignment between the physical rotor positon and the position as supplied by the feedback has been performed at the factory prior to delivery. The resulting offset is stored in parameter **P-0-0508, Commutation offset** in the motor feedback memory (synchronous motor specific parameters).

INDRAMAT motors with housing configured at the factory

This motors can, therefore, immediately be operated without the need for motor-specific settings.

In the case of synchronous kit motors, additional settings must be made at the time of commissioning.

These are:

- motor parameters must be input and
- commutation offset must be determined.

To input the motor parameters, a data sheet from the motor manufacturer can be used. The commutation offset, on the other hand, is determined with the help of command **P-0-0524, Commutation adjustment command.**



WARNING

Error in the control of motor and moving elements.

⇒ Determining the commutation offset must be conducted each time after there has been a change in the mechanical relationship between motor feedback and motor. This is the case, for example, when the encoder or motor are replaced.

Determining the commutation offset

A condition for a chronologically constant torque of the synchronous machine is a fixed allocation between the stator current vector and the vector of the rotor flow. If the angle between these two vectors ($\gamma = 90°$), then the motor will generate its maximum torque. A synchronous motor is operated in this state.

In order to set the stator current vector correctly, the data on γ is needed. This generally necessitates a measuring system which can supply absolute information about this angle. Once the measuring system is mounted to the motor, only the absolute raw position is at first available. The difference between raw positon and absolute angle of rotor and stator field is designated the commutation offset. This is stored, if available, in the motor feedback data memory in parameter **P-7-0508, Commutation offset**.

If this parameter is to be determined, then the commutation setting function must be activated. The following two parameters are intended for this purpose:

- **P-0-0523, Commutation, probe value**
- **P-0-0524, Commutation adjustment command**

Two different processed have been implement. These are:

- mechanical reference between rotor and stator is entered in P-0-0523 and then commutation offset is computed while command P-0-0524 is executed.
- Automatic determination of the commutation offset by switching defined stator current vector on with accompanying automatic measurement.

Which process is used at the state of the **P-0-0524, Commutation adjustment command** depends on the type of motor which has been mounted. It thus applies:

Motor type	Process
LSF (synchronous linear)	reference between rotor and stator is measured (see item 1)
MBS (synchronous rotary)	automatic determination (see item 2)

Fig. 6-7: Setting the commutation offset

Note: To successfully conduct the command, the motor measuring system must be completely operable. The rotational direction of the measuring system must also be set! (See chapter: "Motor encoder“)

Determining the commutation offset in rotary synchronous motors (MBS)

With rotary synchronous motors, the commutation offset is determined by switching into a defined stator current vector. The rotor moves into a torque free positioin. If the unadulterated position of this torque-free position is measured, then the commutation offset can be determined therefrom. This procedure is repeated several times at various positions. The mean value of these measurements equals the commutation offset.

The torque-free position cannot be reached due to extremely friction in the system, then command error

- **D301 Drive not ready for commutation command**

is generated.

The chronological sequece of stator current and relevant angle is illustrated below.

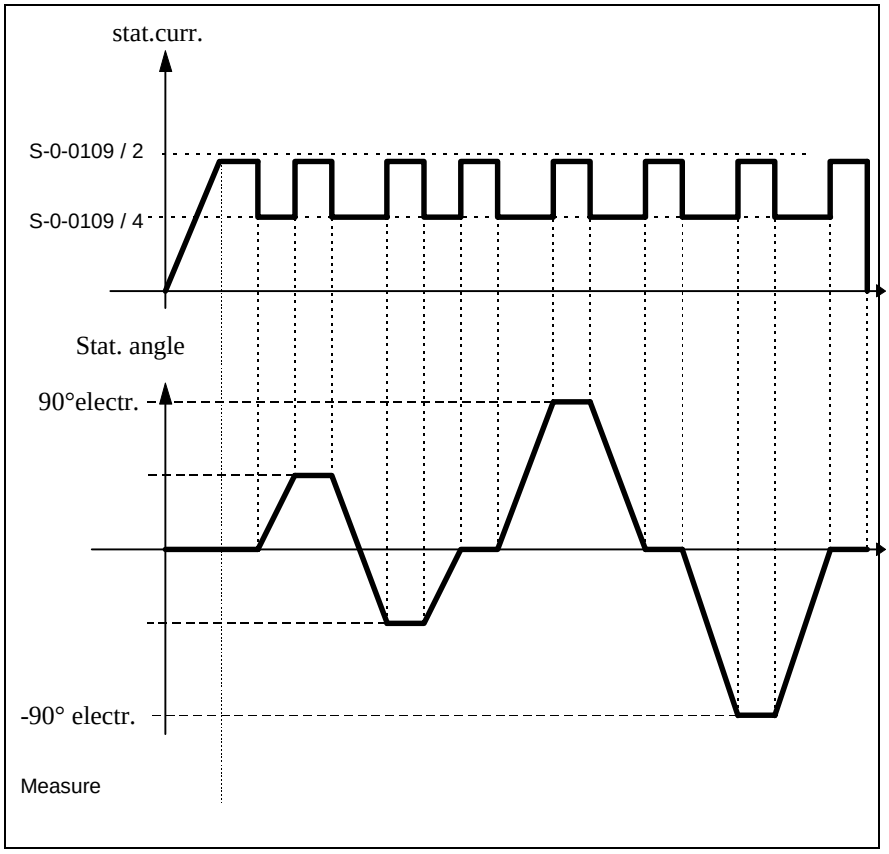


Fig. 6-8: Current and position upon execution of commutation offset determinatino in MBS motors

At command start, the drive must be in mode torque control. If not, then command error **D301 Drive not ready for commutation command** is generated.

In order to be able to re-establish the relationship between motor encoder and rotor after power voltage is switched back on, only those motor encoders are permitted with have an absolute positoin of at least equal to one pole pair.

The following input values for parameter **P-0-0074, Feedback type 1** are permitted:

Possible values for P-0-0074, Feedback type 1 with motor type MBS (rotary synchronous kit motor)	**Motor encoder interface**
1	digital servo feedback DSF or resolver with feedback data storage
8	Heidenhain encoder with Endat Interface
10	Resolver without feedback data storage *)
11	Resolver + incremental encoder with sine signals without feedback data memory *)

Fig. 6-9: Possible motor encoders with motor types "rotary synchronous kit“

Note: *) This motor encoder type has no feedback data memory. Commutation offset is therefore stored in parameter **P-0-0508, Commutation offset** in the programming module. Upon replacement of the module, the value of parameter **P-0-0508, Commutation offset** must be re-entered or the parameter must be stored and loaded out of the previous module.

Determining the commutation offset in linear synchronous motors (LSF)

The commutation offset in linear synchronous motors (LSF) is fixed by measuring the distance between front end of primary part and setting device of the secondary part. This value plus the motor type dependent primary nominal value is entered in parameter **P-0-0523, Commutation, probe value.** Then the command **P-0-0524, Commutation adjustment command** is started. The drive computes the commutation offset from the measured value. To successfully conduct the command, the following conditions must be met:

- The direction of movement of the measuring system must be set so that if the primary part is moving towards the front end at which the power cable of the motor branches off (front end 1, see picture 2), then **S-0-0051, Position feedback 1 value** is moving in a positive direction. (With inverted position polarity!) If this is not the case, then the direction of movement of the motor encoder must be inverted. Do this in bit 3 of **S-0-0277, Position feedback 1 type.**
- The power cables of the motor must be correctly connection (three phases must be assigned).
- The drive must be in **A013 Ready for power on.**
- A characteristic value, K_{entire}, for the primary part of the motor must be determined.

If these conditions have been met, then the distance between front end 2 of the primary part of the setting device (d) can be measured and this value plus the primary part characteristic value K_{entire} can be entered in P-0-0523. Front end 2 means the front end opposite the end where the power cables of the motor emerge.

$$P\text{-}0\text{-}0523 = d + K_{entire}$$

P-0-0523: value determined for parameter P-0-0523
d: measured distance between front end of primary part and setting device
K_{entire}: primary part characteristic value

Fig. 6-10: Determining the measured value of the commutation offset setting in linear synchronous motors (LSF)

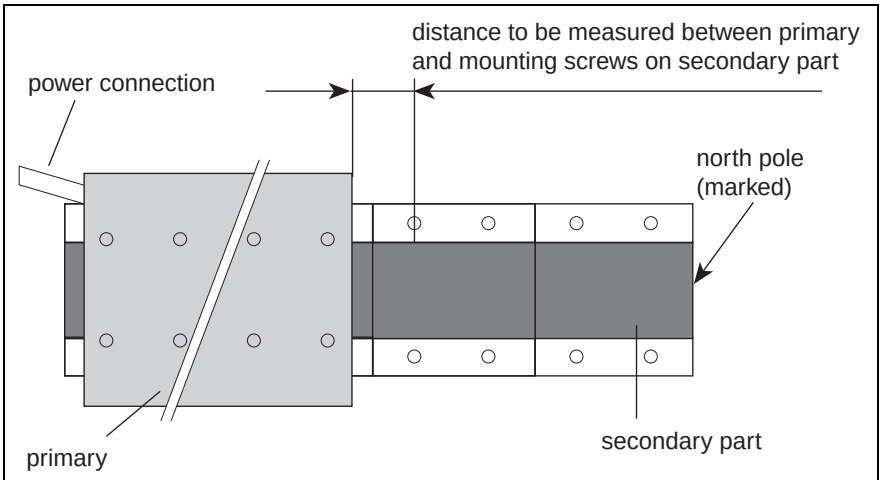


Fig. 6-11: Overview of determining the commutation offset in LSF

Finally, the command **P-0-0524, Commutation adjustment command** is started. The commutation offset is computed during this process.

At command start, the drive must be **A013 Ready for power on.** If not, then command error

D301 Drive not ready for commutation command

is generated.

The command must be cleared when all is completed!

6.5 Motor Holding Brake

A motor holding brake can be mounted via a potential-free contact built into the drive controller . It prevents unwanted axis movements when the drive enable signal is off.

Note: The holding brake is not a working brake. It wears down after about 20,000 motor revolutions if the brake is closed.

To set the motor holding brake, use parameters

- **P-0-0525, Type of motor brake**
- **P-0-0526, Brake control delay**
- **P-0-0126, Maximum braking time**

The parameters for the motor holding brake are automatically set in motors with motor feedback data memory

Parameters **P-0-0525** and **P-0-0526** are automatically set in MHD, MKD and MKE motors. For all other motor types, the values which must be entered are specified in the data sheet of the motor or the motor brake. Parameter **P-0-0126** must be parametrized to meet machine requirements.

Setting the Motor Brake Type

Using parameter **P-0-0525, Type of motor brake** it is possible to set the motor brake type.

It must be identified in terms of:

- self-releasing or self-holding brake
- spindle brake or servo brake

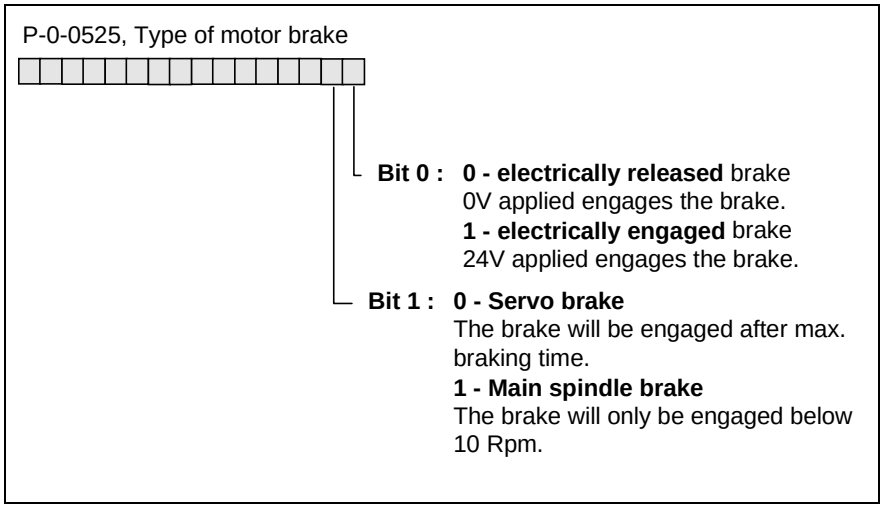

P-0-0525, Type of motor brake
Bit 0 : 0 - electrically released brake
0V applied engages the brake.
1 - electrically engaged brake
24V applied engages the brake.
Bit 1 : 0 - Servo brake
The brake will be engaged after max. braking time.
1 - Main spindle brake
The brake will only be engaged below 10 Rpm.

Fig. 6-12: Setting the motor brake type

Setting the Motor Brake Integral Action Time

In **P-0-0526, Brake control delay** it is necessary to set the time that the motor brake control needs to actually apply the brake.

Note: A standard value for the direct connection of holding brakes of Indramat motors equals 150msec.

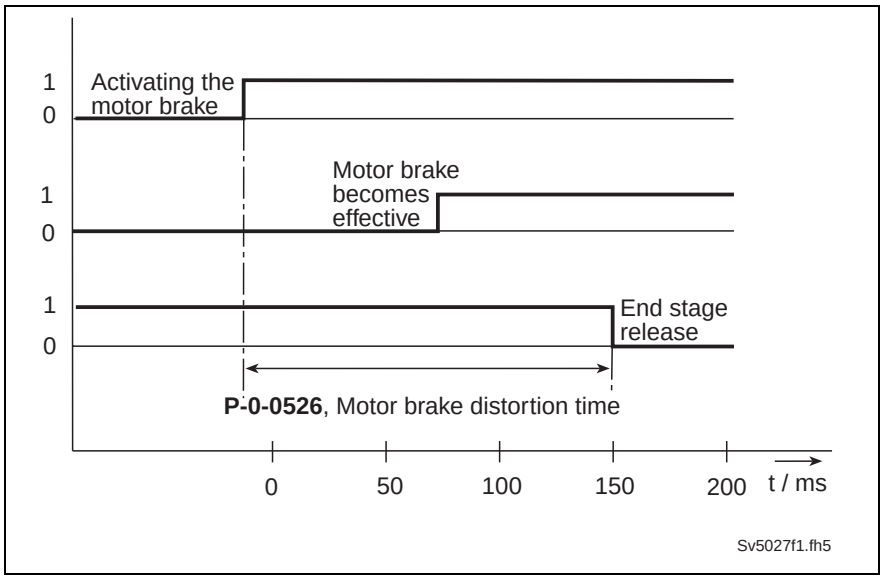


Fig. 6-13: Setting motor brake integral action time

Setting Maximum Decel Time

Parameter **P-0-0126, Maximum braking time** supports decel time monitoring and activation of the motor holding brake if the theoretical decel time is exceeded due to an error.

The motor holding brake is activated if the time set with **P-0-0126, Maximum braking time** and since the start of the error reaction is exceeded.

Note: The value in **P-0-0126, Maximum braking time** must be set so that the drive can come to a standstill with the greatest possible moment of inertia and force from maximum speed.

ATTENTION

If the value in **P-0-0126, Maximum braking time** is too small, then the error reaction is terminated and the motor holding brake activated at a speed greater than 10 RPM. This will damage the brake if permitted to continue over extended periods of time!

The behavior with a spindle brake

P-0-0525, Type of motor brake

bit 1 = 1

The motor holding brake is always activated if the actual speed of the motor drops to less than 10 rpm or 10mm/min (linear motor).

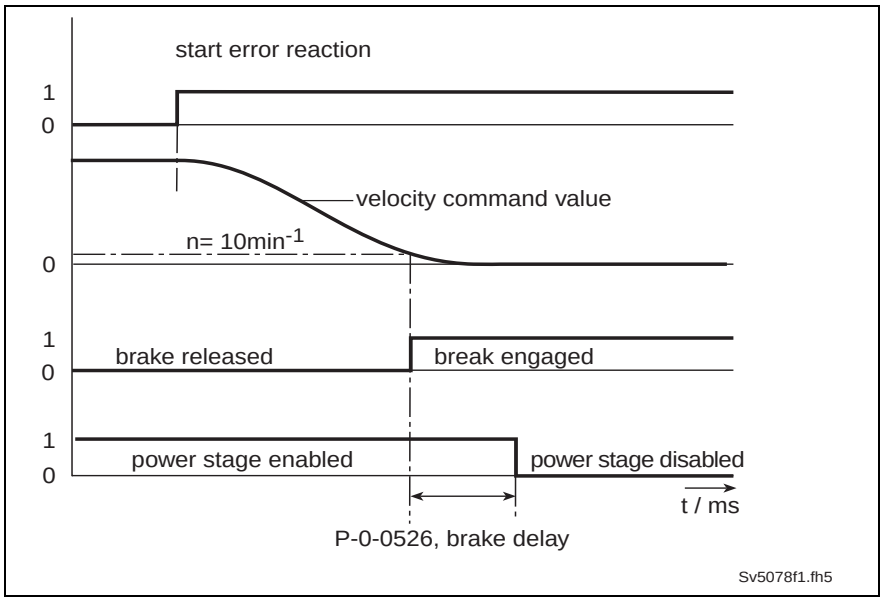


Fig. 6-14: Chronological diagram with command value to zero and P-0-0525, Holding brake type, **Bit 1 = 1** (Spindle brake)

Behavior with servo brake
P-0-0525, Type of motor brake
bit 1 = 0

The brake is activated after the maximum decel time has been reached.

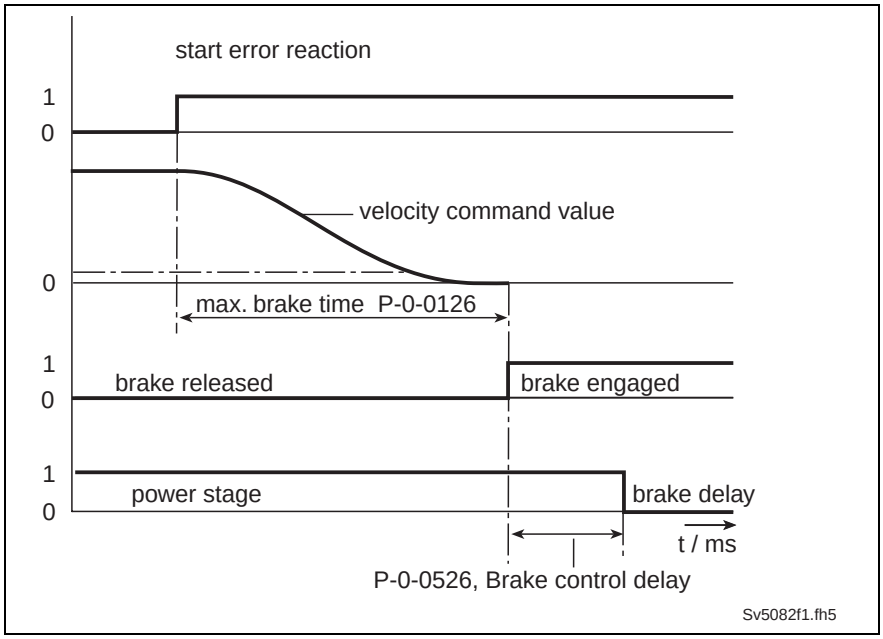


Fig. 6-15: Chronological diagram with command value to zero and P-0-0525, Holding brake type, Bit 1 = 0 (Servo brake) and actual braking time < P-0-0126

Connecting the Motor Holding Brake

See relevant Project Planning Manual for details.

7 Operating Modes

7.1 Setting the Operating Mode Parameters

Depending on the type of command communications used different numbers of operating modes are available.

Command communications with anologinterface

If the drive is controlled via parallel command communicationst, then **two** different modes can be used, namely:

- Primary Mode of Operation and
- Secondary Operating Mode 1.

The main operating mode is defined in parameter **S-0-0032, Primary mode of operation**.

Auxiliary operating mode 1 is permanently set to jog. The drive switches from main to auxiliary modes if input "jog positive" or "jog negative" is actuated.

Command communications with fieldbus interface (Profibus, CANopen, Interbus)

If command communication uses a fieldbus interface then the main and auxiliary operating modes are automatically set in terms of what is set in **P-0-4084, Profile type.**

Note: Specifying a profile type in **P-0-4084** generally also means that specific main and auxiliary modes are automtically set. The only exception is the freely configurable mode (P-0-4084 = 0xFFFE). Here **S-0-032** … **S-0-0033** have to be parametrized.

Note: The parameter description includes a summary list of parameters as to the possible input values for each parameter.

7.2 Determining/detecting the active mode

Note: Depending on the type of command communication parameter S-0-0134, Master control word has various definitions.

Command communication analog interface or parallel interface

If an analog or parallel command communication are used, then bits 8 and 9 in the master control word display which mode Primary Mode of Operation/Secondary Operating Mode 1 is actually working.

Command communication using fieldbus interface (Profibus, CANopen, Interbus)

If command communication uses a fieldbus then bits 8 and 9 in the master control word display the internal mode that is actually effective. The selection for profile types (FFFE, FF91 FF92, FF93) can be made with bits 8+9 in **P-0-4077, Fieldbus control word**!

Note: For all other profile types, once a specific profile type is selected, the related operatintg mode (S-0-0032 … S-0-0035) is also automatically selected.

7.3 Operating Mode: Torque Control

Note: With FGP firmware this is only possible in conjunction with analog operations. (P-0-4084 = 0xFFFE)

In operating mode **torque control** the drive is set with a torque command value. The diagnosis with an active mode reads **A100 Drive in TORQUE control** .

The command value is set in parameter **S-0-0080, Torque/Force command**.

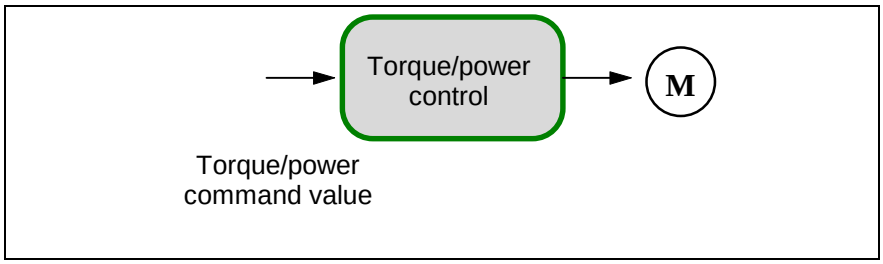


Fig. 7-1: Block diagram of torque control

Pertinent Parameters

- **S-0-0080, Torque/Force command**
- **P-0-4046, Active peak current**
- **P-0-0176, Torque/Force command smoothing time constant**

Torque Control

The command value in **S-0-0080, Torque/Force command** is limited with the effective peak current **P-0-4046, Active peak current**. This current is based on the current and torque limits.

(See section: "Current limits" and "Torque control").

The limited torque command value is filtered through a filter of the 1st order. The time constant of the filter is set in parameter **P-0-0176, Torque/Force command smoothing time constant**.

After limiting and filtering, the effective torque-generating command value is generated. It is the command value for the effective current control.

Using „Analog output of predefined signals“ the effective command current analog can be output.

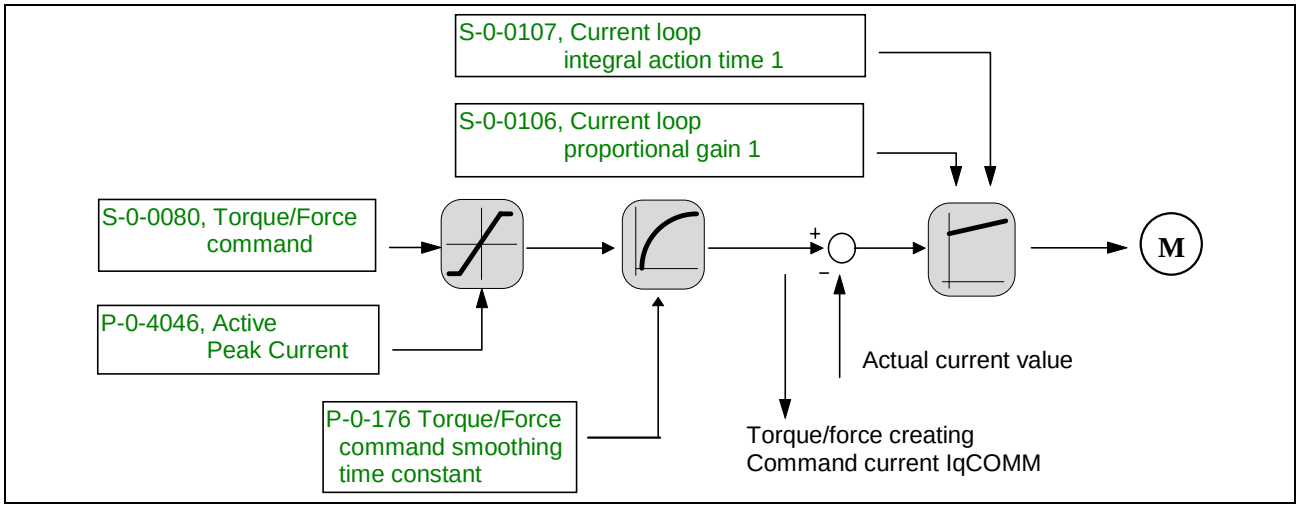


Fig. 7-2: Torque control

Diagnostic Messages

Operating mode-specific monitors are

- Monitoring actual velocity for a 1.125 fold value of parameter **S-0-0091, Bipolar velocity limit value**.

(See also section: "Limiting bipolar velocity limit value").

If this value is exceeded, then error **F879 Velocity limit S-0-0091 exceeded** is generated.

7.4 Mode: Velocity Control

Note: This operating mode is activated with the selection of profile P-0-4084 = 0x0003 or P-0-4084 = 0xFF93 or with analog operations with P-0-4084 = 0xFFFE

A velocity value is commanded to the drive in the **Velocity Control** operating mode. The velocity command value is limited with ramps and a filter. The diagnostic message reads **A101 Drive in VELOCITY control** when the operating mode is active.

The command values are specified in the parameters **S-0-0036, Velocity command value** and **S-0-0037, Additive velocity command value**.

Pertinent Parameters

- **S-0-0037, Additive velocity command value**
- **S-0-0036, Velocity command value**
- **S-0-0091, Bipolar velocity limit value**
- **P-0-1201, Ramp 1 pitch**
- **P-0-1202, Final speed of ramp 1**
- **P-0-1203, Ramp 2 pitch**
- **P-0-1222, Velocity command filter**

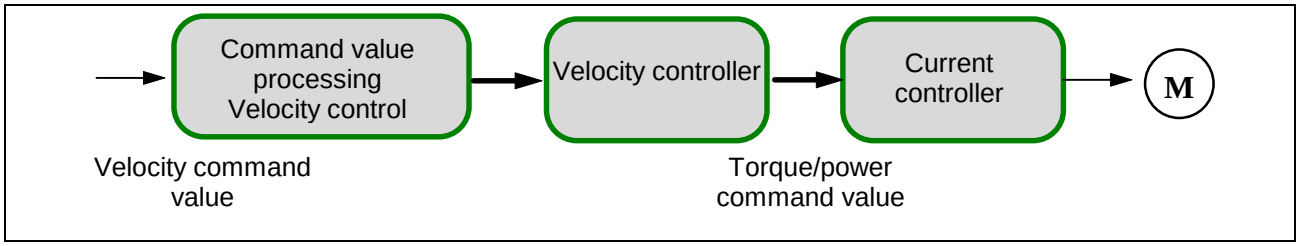


Fig. 7-3: Velocity control block diagram

Command value processing Velocity control

The given **S-0-0036, Velocity command value** is limited to **S-0-0091, Bipolar velocity limit value**. Is the command value higher the message **E263 Velocity command value > limit S-0-0091** is shown. The command value is then accel limited via **P-0-1201, Ramp 1 pitch**. If command velocity exceeds the velocity in parameter **P-0-1202, Final speed of ramp 1,** then the command value is accel limited in terms of value **P-0-1203, Ramp 2 pitch**. The limit velocity command is jerk limited by means of a filter of the 1st order (**P-0-1222, Velocity command filter)**.

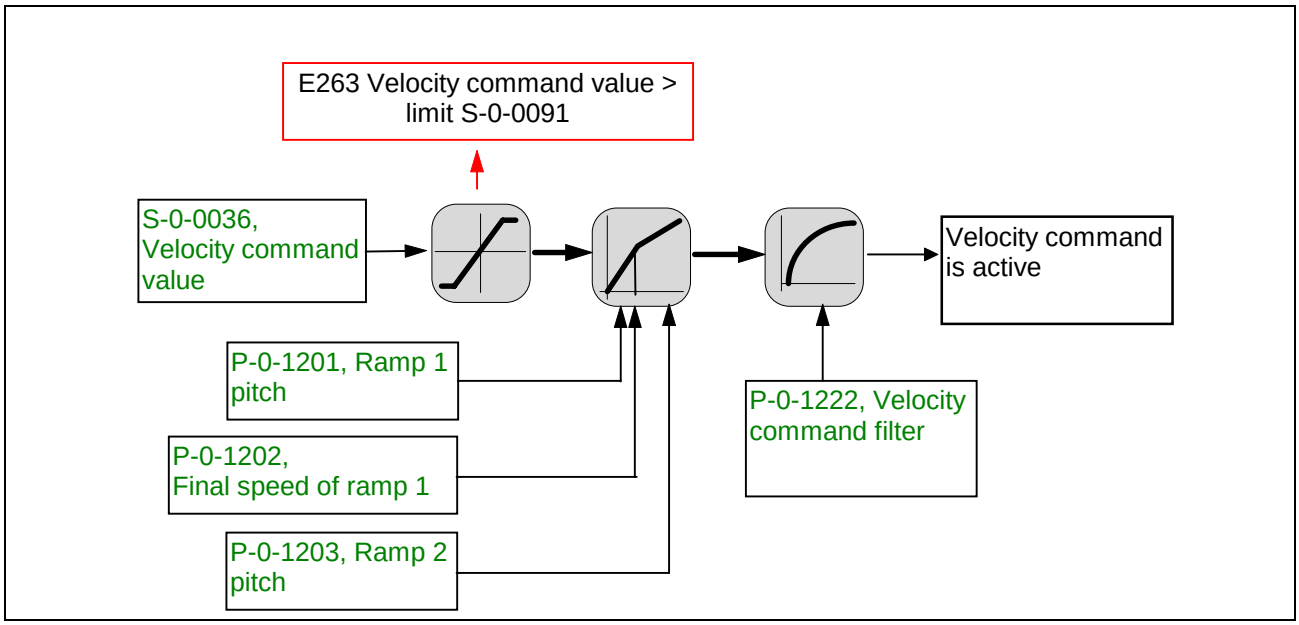

E263 Velocity command value > limit S-0-0091
S-0-0036, Velocity command value
Velocity command is active
P-0-1201, Ramp 1 pitch
P-0-1202, Final speed of ramp 1
P-0-1203, Ramp 2 pitch
P-0-1222, Velocity command filter

Fig. 7-4: Command value processing: Velocity Controller

See also chapter: "Velocity Controller"

See also chapter: "Current Controller".

Velocity Controller

The effective velocity command value is added with **S-0-0037, Additive velocity command value**.

Further he is limited to **S-0-0091, Bipolar velocity limit value**.

(See also chapter: "Limiting to Bipolar Velocity Limit Value")

If the resulting command value is at the limit, the warning **E259 Command velocity limit active** is displayed.

The velocity control difference is produced by including the actual velocity in the control loop. The raw feedback velocities of the motor and, if available, the external encoder can be combined into an effective actual velocity value. (See also chapter: " Setting the Velocity Mix Factor".)

Via **P-0-0004, Velocity loop smoothing time constant** you can limit the band of the control difference for the current controller.

This variable is then relayed to the current and toqrue limits.

(See also chapter: " Current Limit" and "Torque/Force Limitation".)

To filter mechanical resonance frequencies, a notch filter can be applied to this torque/force command value. Using parameter **P-0-0180, Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop** the frequency range which must be suppressed and be parametrized.

(See also "Setting the Velocity Controller".)

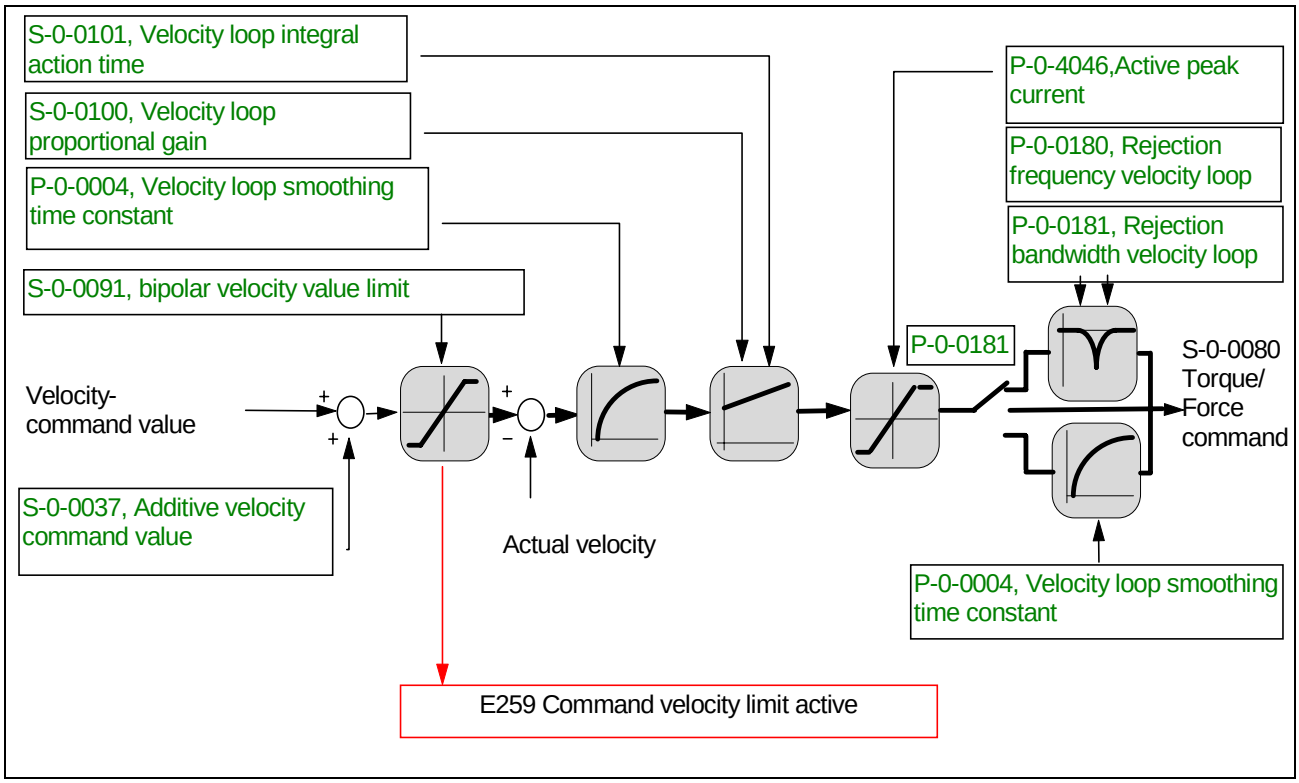

S-0-0101, Velocity loop integral action time
S-0-0100, Velocity loop proportional gain
P-0-0004, Velocity loop smoothing time constant
S-0-0091, bipolar velocity value limit
P-0-4046,Active peak current
P-0-0180, Rejection frequency velocity loop
P-0-0181, Rejection bandwidth velocity loop
P-0-0181
S-0-0080 Torque/ Force command
Velocity- command value
S-0-0037, Additive velocity command value
Actual velocity
P-0-0004, Velocity loop smoothing time constant
E259 Command velocity limit active

Fig. 7-5: Velocity Controller

See also chapter: "Command value processing Velocity control"

See also chapter: "Current Controller".

Current Controller

The current controller is parameterized with **S-0-0106, Current loop proportional gain 1** and **S-0-0107, Current loop integral action time 1**.

(See also chapter: "Setting the Current Controller".)

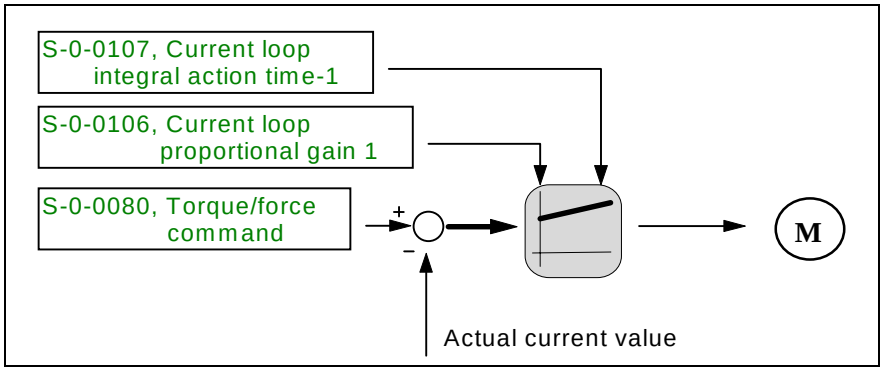


Fig. 7-6: Current Controller

Diagnostic Messages

Operating mode specific monitors are

- **E259 Command velocity limit active**
  If the resulting command value is in the limit, then warning **E259 Command velocity limit active** is displayed.
- **E263 Velocity command value > limit S-0-0091** .
  Parameter **S-0-0036, Velocity command value** is set to the value of parameter **S-0-0091, Bipolar velocity limit value**. The warning **E263 Velocity command value > limit S-0-0091** is generated.

7.5 Mode: Position Control

Note: The operating mode is activated in the drive with profile types P-0-4084 = 0xFF92 and possibly P-0-4084 = 0xFFFE.

A position value is commanded to the drive every NC-cycle time in the **Position Control** operating mode. The timebase is defined here in **S-0-0001, NC Cycle time (TNcyc)**. When this mode is activated, the diagnostic message is one of the following:

- **A102 Position Control Encoder 1**
- **A103 Position Control Encoder 2**
- **A104 Position Control Encoder 1 Lagless Positioning**
- **A105 Position Control/ Encoder 2 / Lagless Positioning**

The command value is specified in the parameter **S-0-0047, Position Command Value** .

Monitors specific to this operating mode are:

- Monitoring the command velocity at the value of the parameter **S-0-0091, Bipolar velocity limit value**.

If this value is exceeded, the error **F237 Excessive position command difference** is generated.

The command value specified in **S-0-0047, Position Command Value** is interpolated within the NC cycle time and is then given to the position controller.

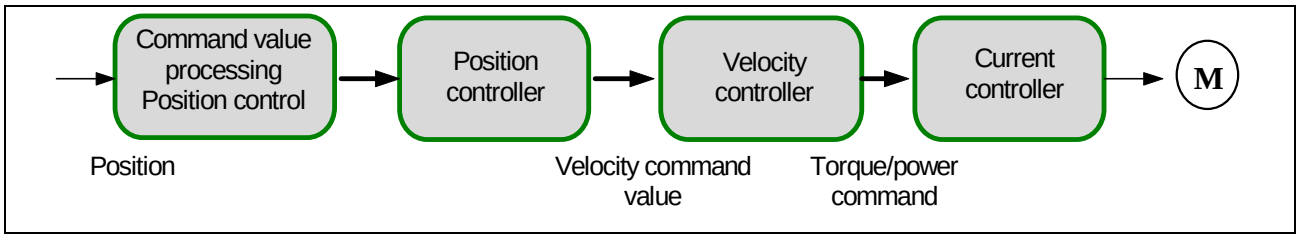


Fig. 7-7: Position control block diagram

Command value processing : Position Control

A command velocity is formed from two successive position command values. The **S-0-0001, NC Cycle Time (TNcyc)** acts as the time base.

The instructions for calculating the command velocity are as follows:

$$Vcommand = \frac{Position\,command\,value(k) - Position\,command\,value(k-1)}{S-0-0001}$$

Vcommand: Command velocity

Fig. 7-8: Calculating the command velocity

This velocity is monitored to see if it exceeds **S-0-0091, Bipolar Velocity Limit Value** (see also Position Command Value Monitoring. If **S-0-0091** is exceeded, the error **F237 Excessive position command difference** is generated.

The commanded position profile can be filtered with the parameter **P-0-0099, Position command smoothing time constant**.

The position loop is closed every 500usec. The position command value is also fine interpolated within the NC cycle time.

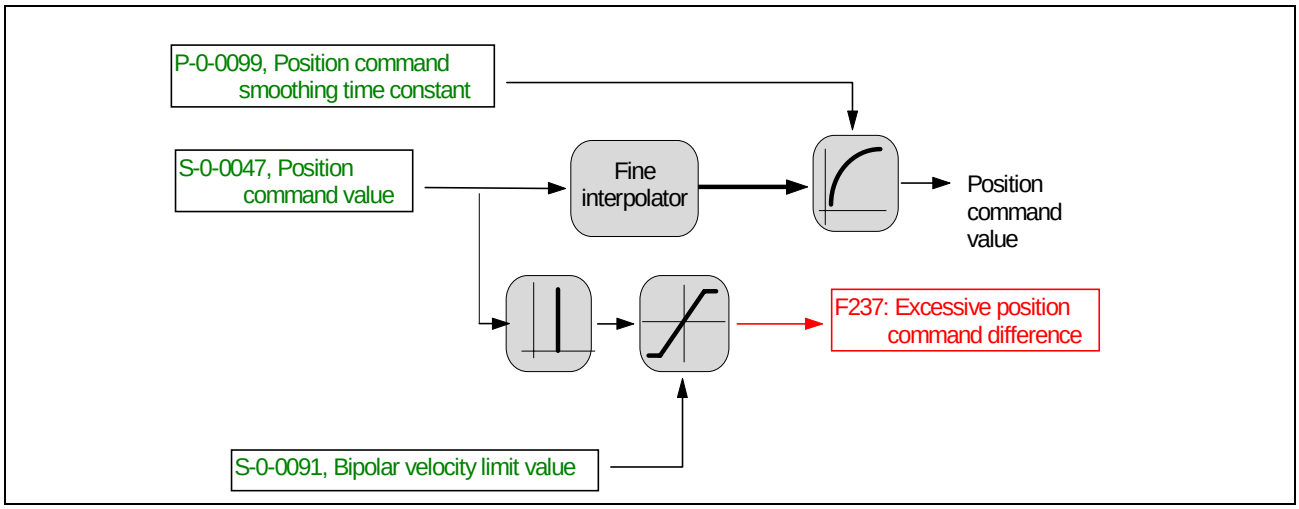

P-0-0099, Position command smoothing time constant
S-0-0047, Position command value
Fine interpolator
Position command value
F237: Excessive position command difference
S-0-0091, Bipolar velocity limit value

Fig. 7-9: : Command value processing: position control

See also Current Controller

See also Velocity Controller

See also Position Controller

Position Controller

The position controller error is computed from the effective position command value from the generator function of the active operating mode and the actual position value (encoder 1 or encoder 2) used for the controller. This is given to the position controller, whose control gain is set with **S-0-0104, Position Loop Kv-Factor** . Bit 3 in the operating mode parameters (S-0-0032..35) indicates if positioning should be subject to the following errors.

Definition of bit 3 of operating mode paramets (S-0-0032 to S-0-0035)

Bit 3=1	lagless	(with velocity precontrol)
Bit 3=0	with lag	(without velocity precontrol)

With lagless position control, an acceleration feed forward component can be included with parameter **S-0-0348, Acceleration Feedforward prop. Gain**.

(See also: "Setting the Acceleration Feed Forward".)

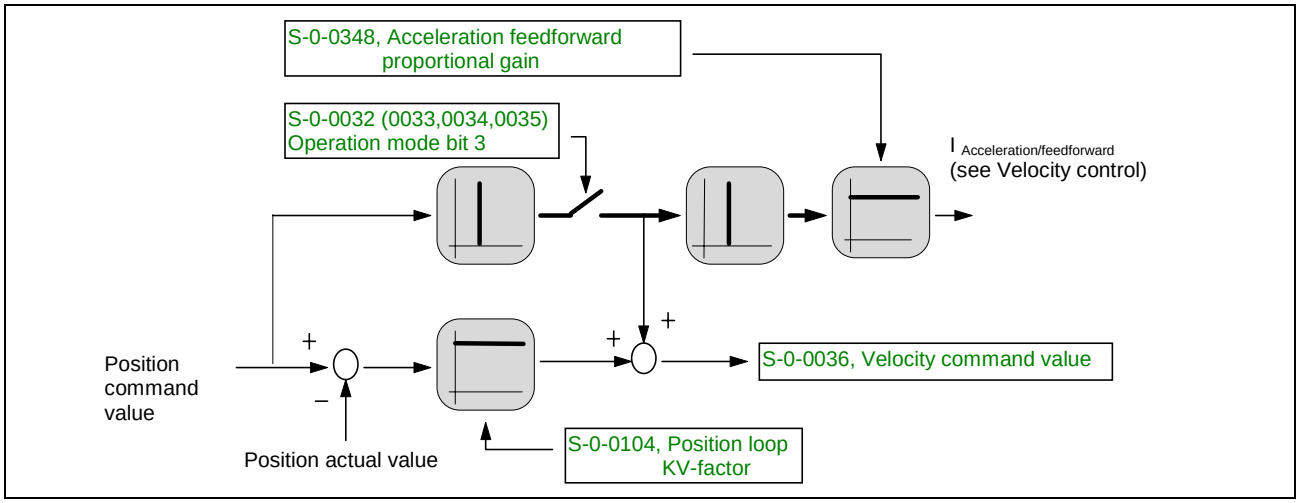


Fig. 7-10: Position controller

See also Current Controller

See also Velocity Controller

Position Command Value Monitoring

If the drive is operated in the position control mode with cyclical position commands, new position values are transmitted to the drive every NC cycle **(S-0-0001, NC Cycle time (TNcyc)**. The difference between the current and the last position command value is checked for validity.

Reasons monitoring is activated:

- Erroneous control system command values
- Command value transmission error

If the **Position Control** operating mode is active, the velocity produced by the difference in successive values of parameter **S-0-0047, Position Command Value** is compared to

- **S-0-0091, Bipolar Velocity Limit Value**

S-0-0001, NC Cycle Time (TNcyc) acts as the time base for converting the position command value differences into a velocity.

If the command velocity resulting from the position command value exceeds **S-0-0091, Bipolar Velocity Limit Value**, the error

- **F237 Excessive position command difference**

is generated. For diagnostic purposes, both of the parameters

- **P-0-0010, Excessive Position Command Value**
- **P-0-0011, Last valid Position Command Value**

will be saved. The velocity produced by the difference of the two values generated the error.

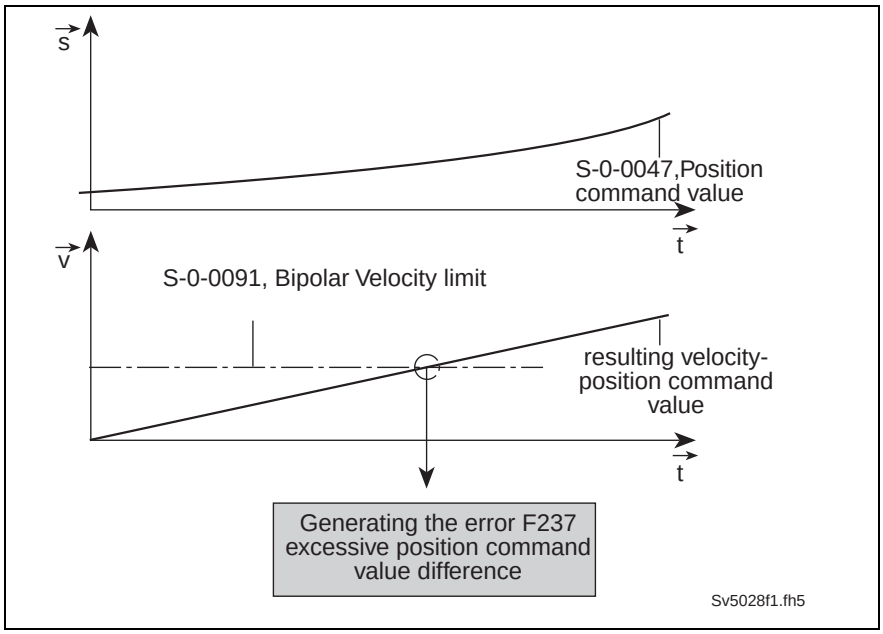


Fig. 7-11: Monitoring the position command value differences and generating the error **F237 Excessive position command difference**

Setting Position Command Value Monitoring

The position command value monitor works with the parameter **S-0-0091, Bipolar Velocity Limit Value**. It should be set with approximately 5 to 10% above the planned maximum velocity of the shaft.

7.6 Operating Mode: Drive Internal Interpolation

Note: The operating mode is activated in the drive by selecting profile P-0-4084 = 0x0001 or P-0-4084 = 0xFF91 as well as P-0-4084 = 0xFFFE.

The drive is given a target position in **Drive Internal Interpolation** mode. When it is activated, the diagnostic message is one of the following:

- **A106 Drive Controlled (Internal) Interpolation / Encoder 1**
- **A107 Drive Controlled Interpolation / Encoder 2**
- **A108 Drive Controlled Interpolation / Encoder 1 / Lagless**
- **A109 Drive Controlled Interpolation / Encoder 2 / Lagless**

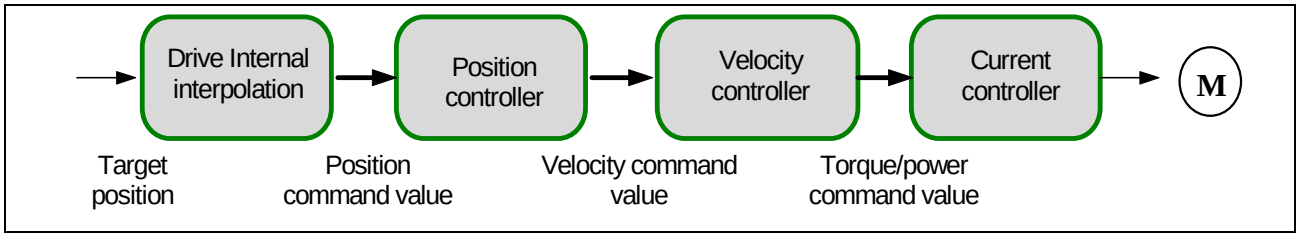


Fig. 7-12: Drive-internal interpolation diagram

Functional principle Drive Internal Interpolation

The target value is entered in the parameter **S-0-0258, Target Position** . The drive generates the position command profile necessary to move to the target position using the following parameters as limits:

- **S-0-0259, Positioning velocity**
- **S-0-0260, Positioning acceleration**
- **S-0-0193, Positioning jerk**
- **S-0-0108, Feedrate override**

Upon activating the operating mode, depend on **S-0-0393, Command value mode,** the traversing path relates to the actual position or the value in parameter **S-0-0258, Target position**.

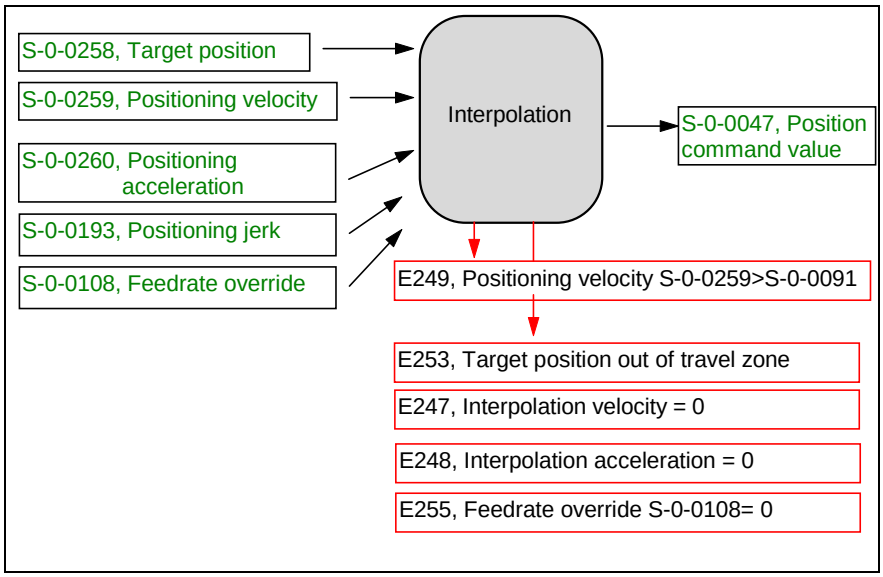


Fig. 7-13: Generator function drive internal generator function

See also position controller

See also velocity controller

See also current controller

Monitoring in mode: "Drive-internal interpolation"

The following checks are executed:

- If axis limit value monitoring is activated (Bit 4 of **S-0-0055, Position Polarity Parameter** is set) and the measurement system used for the operating mode has been homed, the parameter **S-0-0258, Target Position** is monitored for staying within the axis limit values (S-0-0049 bzw. S-0-0050).
  If these are exceeded, the warning **E253 Target position out of travel zone** is generated.

  The prescribed target position will not be accepted.
- If the prescribed positioning velocity **S-0-0259, Positioning velocity** exceeds the maximum allowable (**S-0-0091, Bipolar Velocity Limit Value**), the warning **E249 Positioning velocity S-0-0259 > S-0-0091** will be generated.

  The drive will move at the velocity **S-0-0091, Bipolar Velocity Limit Value** to the new target position.
- If the positioning velocity specified in **S-0-0259, Positioning velocity** equals 0, then warning **E247 Interpolation velocity = 0** is generated.
- If the factor affecting positioning velocity as set in **S-0-0108, Feedrate override** equals 0, then warning **E255 Feedrate-override S-0-0108 = 0** is generated.
- If the positioning acceleration specified in **S-0-0260, Positioning acceleration** equals 0, then warning **E248 Interpolation acceleration = 0** is generated.

Status messages during operating mode "Drive-internal interpolation"

In parameters S-0-0013, class 3 diagnostics and S-0-0182, manufacturers class 3 diagnostics there are the following status messages for this mode:

- ***target position reached***, bit 12 of **S-0-0013, Class 3 Diagnostics**
- ***In target position***, bit 10 of **S-0-0182, Manufacturer Class 3 Diagnostics**
- ***IZP***, bit 6 of **S-0-0182, Manufacturer Class 3 Diagnostics**

Also see parameter description: "Status class bits"

The following profile explains how the status messages work:

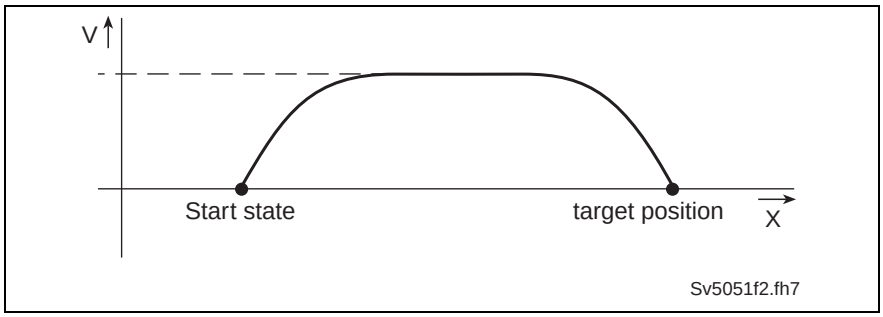


Fig. 7-14: Profile to explain how the interpolation status messsages work

In this example, the drive is at the start position, when the new target position is given.

The following time diagrams result:

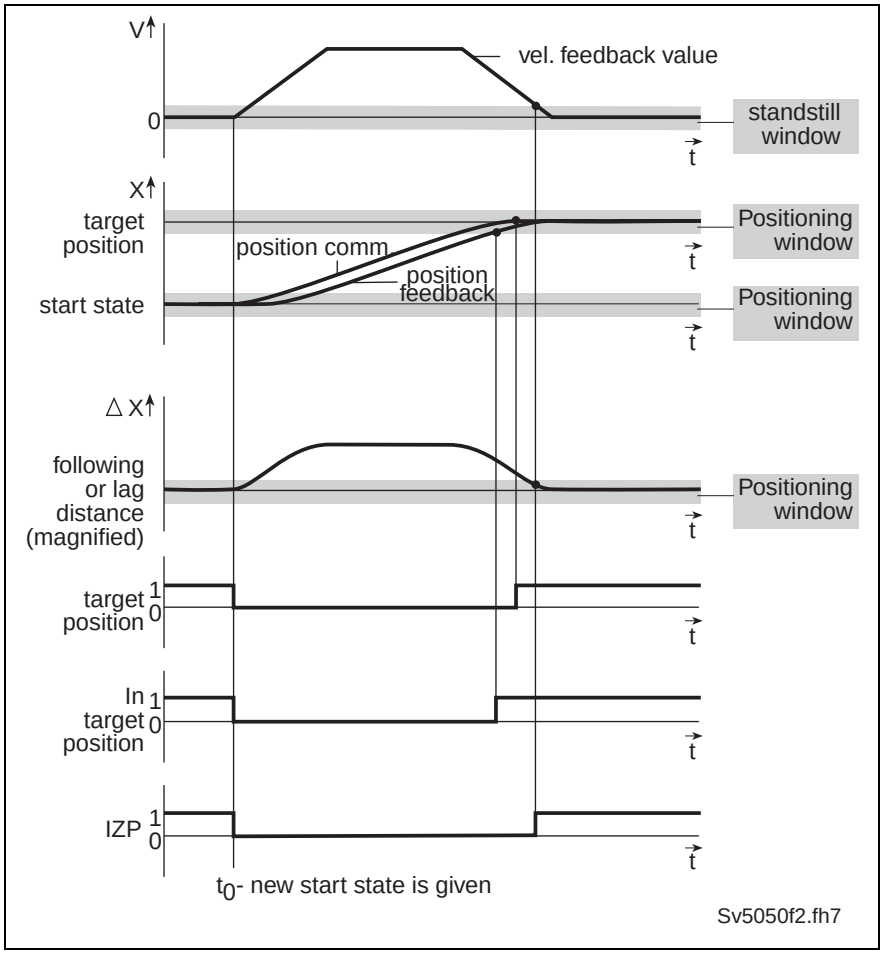


Fig. 7-15: Generating the status bit of the operating modes with drive-internal interpolation

7.7 Positioning Block Mode

Note: With the profile types**:**
-P-0-4084, Operation mode selection code = 0xFF80 or
-P-0-4084, Operation mode selection code = 0xFF81 or
-P-0-4084, Operation mode selection code = 0xFF82

the operating mode "positioning block mode" is automatically internally set!

Positioning blocks that have been preprogrammed can be run with this mode. The drive runs position controll to a target position, while maintaining speed, acceleration and jerk limits as defined for each block.

The positioning blocks are actuated by the block selection.

Following block processing permits execution of several positioning blocks processed in direct sequence without having to re-issue a start signal each time.

Typical applications are positioning processes which cover long distances at high speeds (rapid traverse) and then position at end position at low speeds without any intermediate stops.

- Taking up or putting down transport goods by robots.
- Execution of joining processes in assembly facilities

A following block chain is made up of a start block and one or more following blocks. The start block is selected and activated in the usual manner. The transition to a following block, however, can vary.

Note: Following block mode is possible with absolute and relative positioning blocks. The distance remaining is stored. The final block of a chain is not defined as a following block. This identifies the end of the chain.

Pertinent Parameters

P-0-4006, Process block target position

P-0-4007, Process block velocity

P-0-4008, Process block acceleration

P-0-4009, Process block jerk

P-0-4019, Process block mode

P-0-4026, Process block selection

P-0-4051, Process block acquittance

P-0-4052, Positioning block, last accepted

P-0-4057, Positioning block, input linked blocks

P-0-4060, Process block control word

S-0-0346, Setup flag for relative command values

S-0-0182, Manufacturer class 3 diagnostics

S-0-0259, Positioning Velocity

How it works

Positioning block elements

A positioning block is defined with:

- **P-0-4006, Process block target position,**
- **P-0-4007, Process block velocity,**
- **P-0-4008, Process block acceleration,**

- **P-0-4009, Process block jerk,**
- **P-0-4019, Process block mode.**

and fixes how the target position is to be processed (**absolute**, **relative**).

Note: Each parameter has 64 elements, whereby the elements of the same number write this number into the travel profile of the positioning block.

Positioning block control word

With parameter **P-0-4060, Process block control word** the positioning speed can be limited to the value set in parameter **S-0-0259, Positioning Velocity**. Otherwise, the speed set in **P-0-4007, Process block velocity** is used.

If a positioning block is completed, then bit 12 is set in parameter

S-0-0182, Manufacturer class 3 diagnostics

(→ |target position-actual positon value| < positioning window).

Activating Positioning Blocks

"Positioning block mode" must be entered as the main mode. By activating drive enable and setting drive halt =1 the drive is in primary mode of operation.

A positioning block is started by

- **Toggling** parameter **S-0-0346**, **Setup flag for relative command values**
- **Set** the start signals (**P-0-4077, Fieldbus control word** Bit1) or strobe signals (**P-0-4077, Fieldbus control word**, Bit3) in **I/O mode.**

Note: As long as the parameter is not toggled, the drive will remain on the actual position or brought to a position controlled standstill.

Block selection

In positioning block mode, a positioning block is selected

- by writing into **P-0-4026, Process block selection**
- or with **Bit 8 - Bit13** in **P-0-4077, Fieldbus control word** in **IO mode.**

Positioning Block Modes

Parameter **P-0-4019, Process block mode** is used to set the manner in which the target position is processed in parameter **P-0-4006, Process block target position**.

Possible positioning block modes:

- **Absolute Positioning**
- **Relative Positioning**
- **Relative Positioning with residual path memory**
- **Infinite travel in positive / negative direction**
- **Following block processing**

Absolute Positioning

Prerequisite: Parameter **P-0-4019, Process block mode** = 1

In an absolute positioning block, the target position is a fixed (absolute) position within the machine coordinate system.

Prerequisites for the execution of absolute positioning blocks:

- The drive must be referenced.
- The travel range can be limited with position limit value. Absolute positioning blocks are only executed if the target position lies within the allowable travel range.

Example Absolute positioning with target position = 700

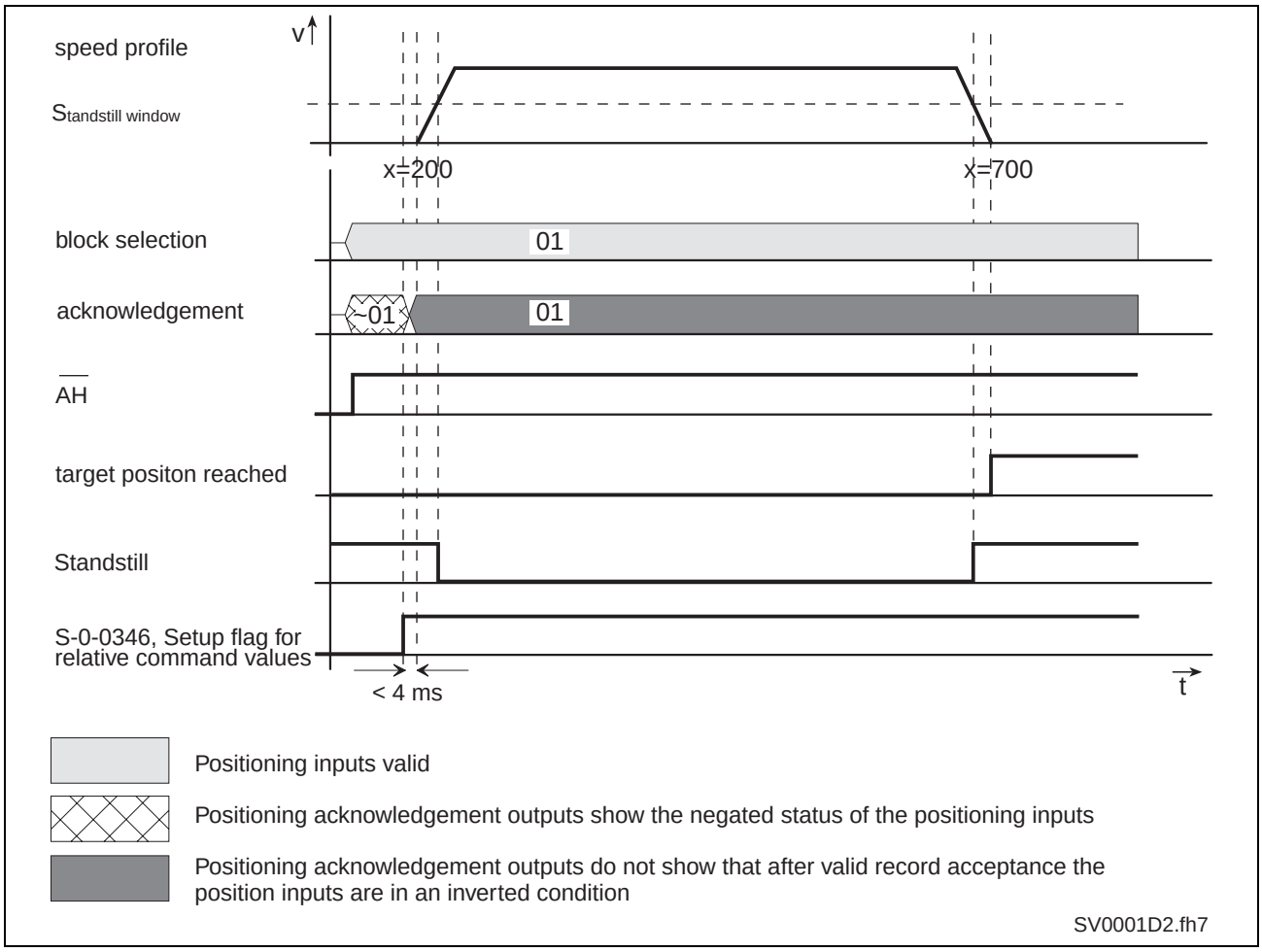


Fig. 7-16: Absolute positioning block

Relative positioning

Prerequisite: Parameter **P-0-4019, Process block mode** = 2

Relative positioning blocks are executed if the drive has not been referenced.

Reference position

In relative positioning blocks without residual path storage, the target position in the positioning blocks are added to the **current position.**

Residual path

If positioning blocks are interrupted, then a part of a path to the target position remains. This remaining distance is the residual path.

Chain dimensional reference

By sequencing relative positioning blocks it is possible to position with chain dimensional reference. If a relative block is interrupted **without residual** path storage, then this chain reference is **lost**.

If the positioning block is completed, i.e., the drive reaches target position and message "end position reached" is activated, then positioning is possible without the loss of the chain reference.

Note: If infinite positioning in either a forward or backward direction is achieved by sequencing relative positioning blocks (transport belt), then the position data must be scaled in modulo format . (Modulo value = transport belt length or modulo value = 2 times the maximum travel distance.)

Example Relative positioning without residual path storage with target position = 700 (current position = 200).

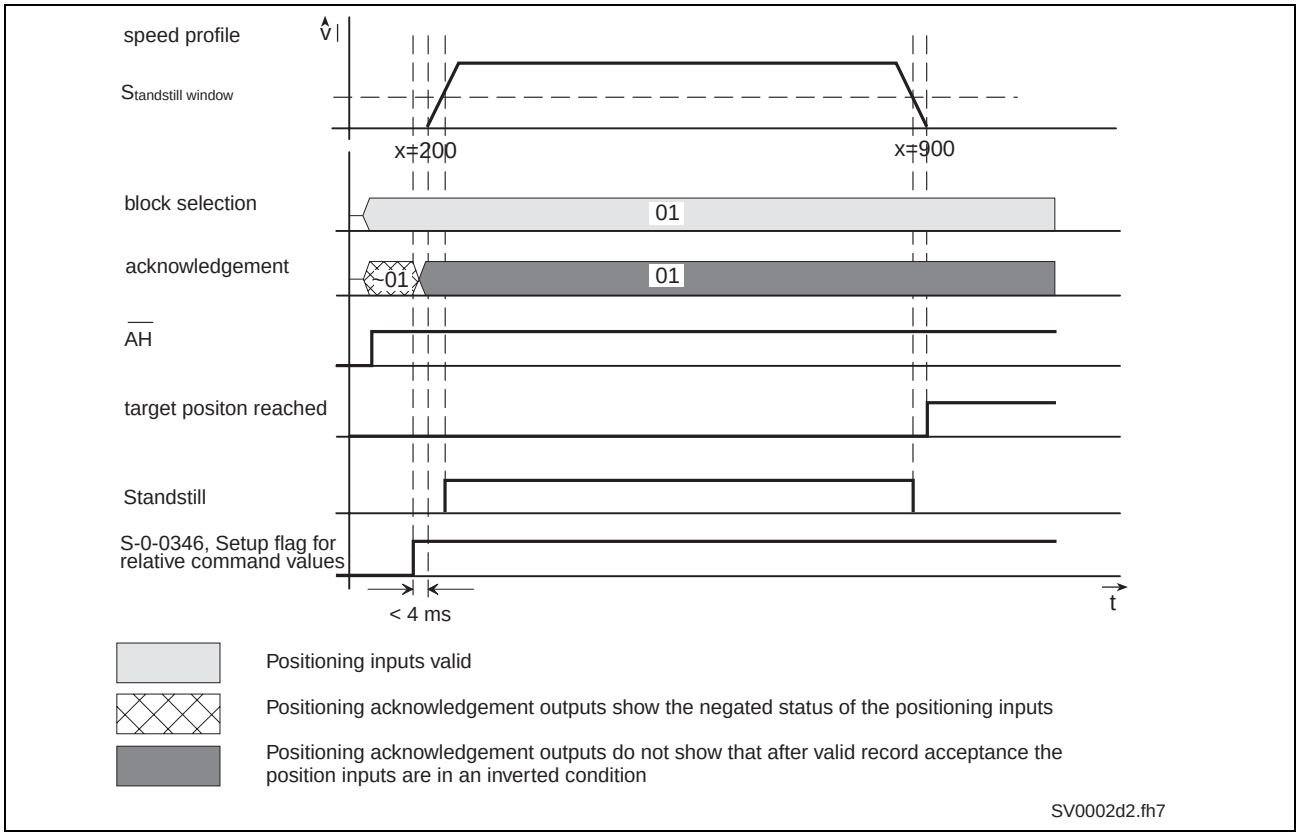


Fig. 7-17: Relative positioning block without residual path storage

Example Relative positioning without residual path storage with target position = 700 (current position = 200). Terminate and start a relative positioning block without residual path storage again.

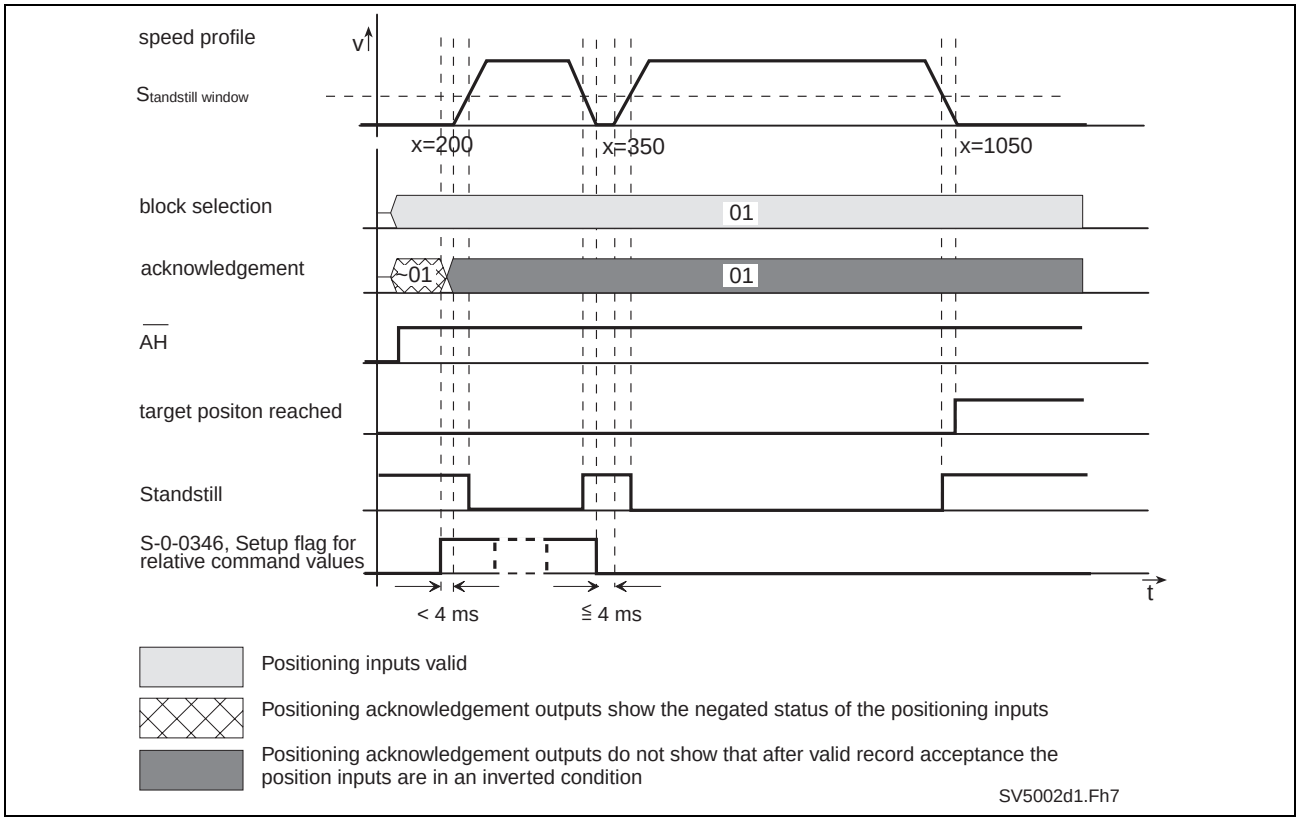


Fig. 7-18: Terminating a relative positioning block without residual path storage

Relative positioning with residual path storage

Prerequisite: Parameter **P-0-4019, Process block mode** = 102h

Relative positioning blocks with residual path storage are also executed if the drive is not referenced.

In a relative positioning block with residual path storage, the target position is a relative path which relates to the target position which last generated the message "end position reached".

Chain dimensional reference

By sequencing relative positioning blocks it is possible to position with chain dimensional reference. If a relative block is interrupted **with residual** path storage, then this chain reference is **retained**.

Note: The rest of the path is discarded once a different positioning block is started.

Example

Relative positioning with residual path storage with target position = 700 without interruption (message: "End position reached" with position = 200).

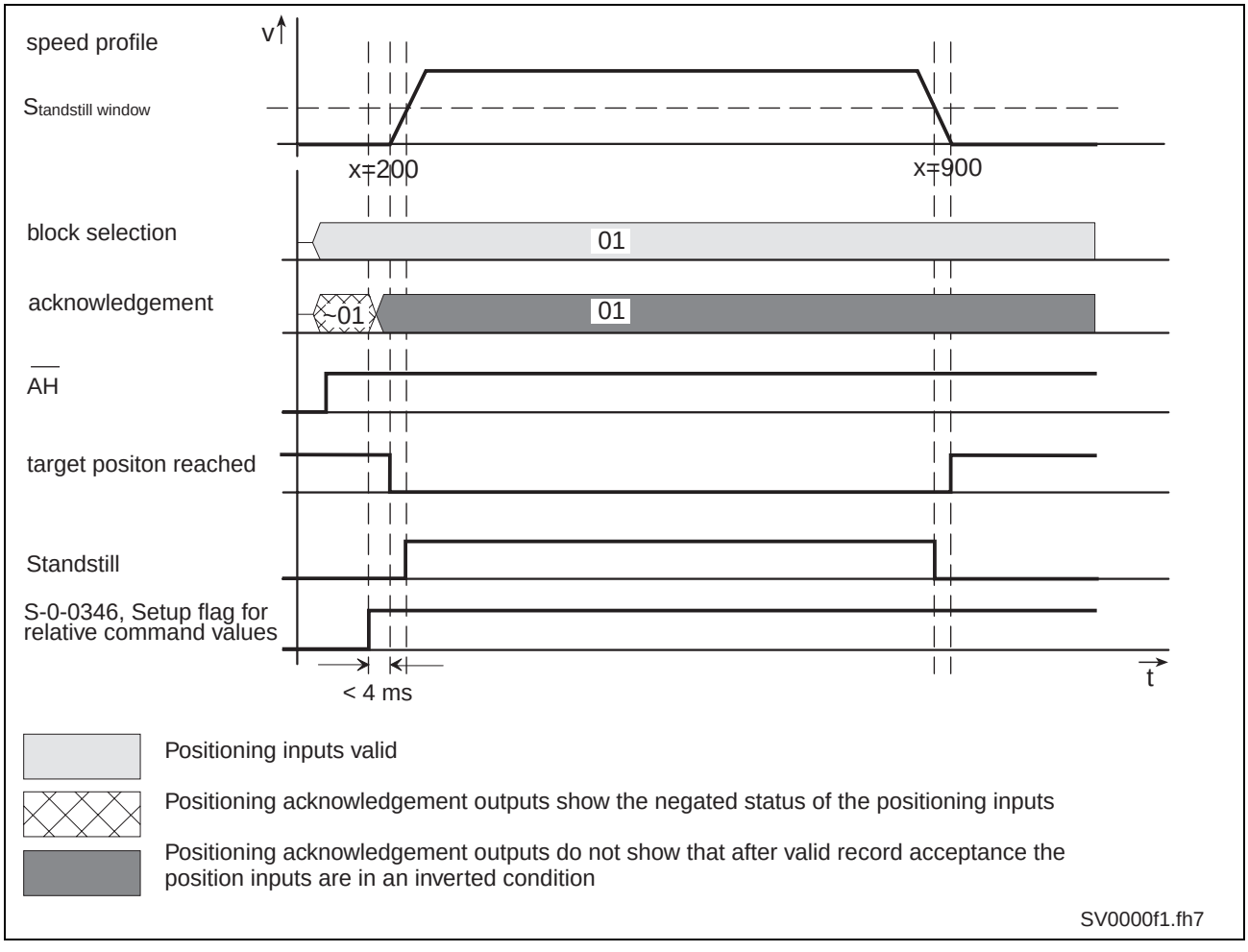


Fig. 7-19: Relative positioning block with residual path storage

Relative positioning block with residual path storage after activating drive enable

Reference position

The **last "End position reached" message** is used as reference position.

Note: The chain reference dimension is guaranteed.

Example An interrupted relative positioning block with residual path storage after active drive enable with target position = 600.

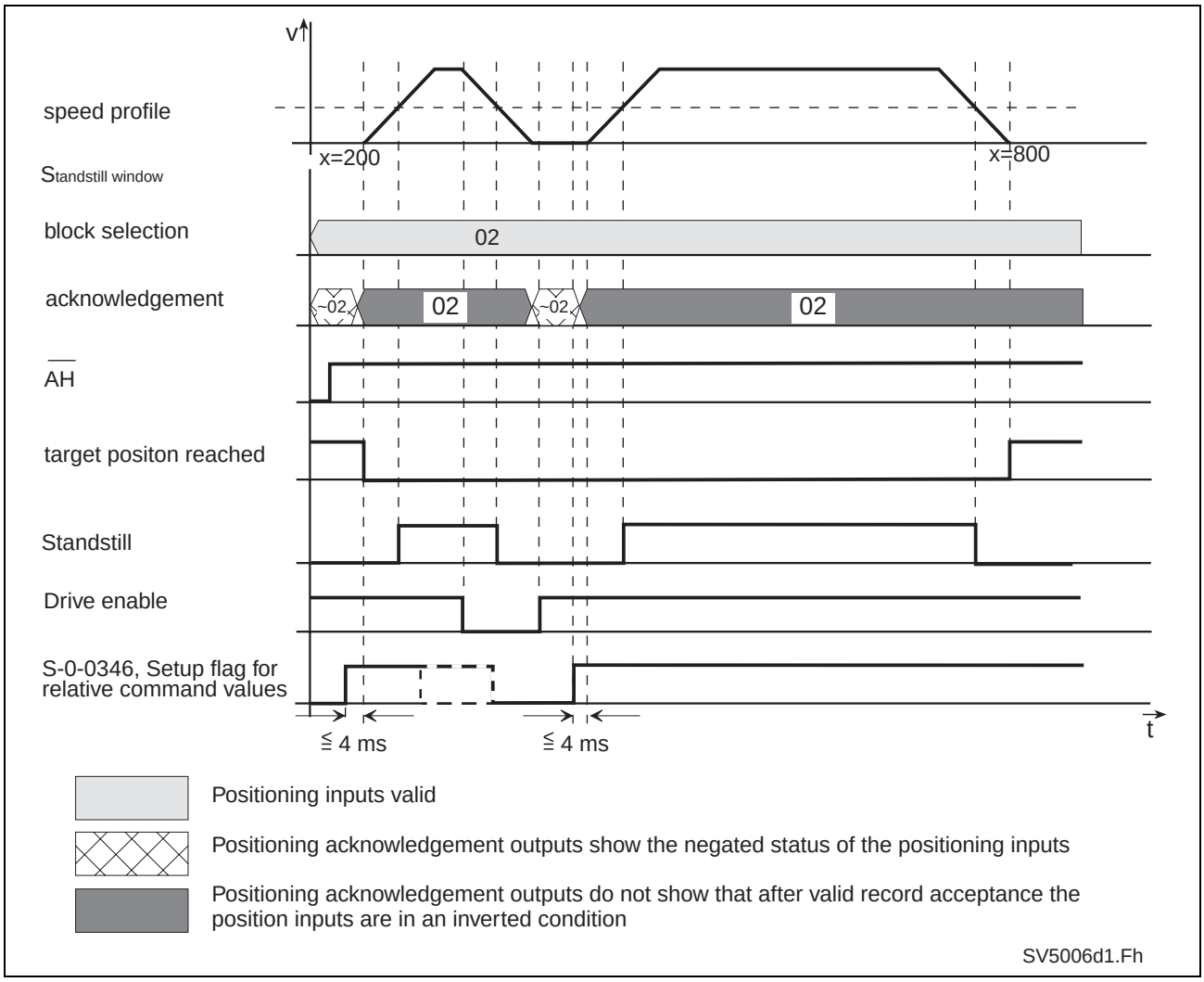


Fig. 7-20: Relative positioning block with residual path storage after activating the drive enable

Relative positioning block with residual path storage after interrupting with jog mode

Example Interrupted relative positioning block **with** residual path storage after jogging with target position = 600 **without overrunning the target position** while jogging.

Reference position The **last "End position reached" message** is used as reference position.

Behavior The stretch jogged between the **interruption** and **restart** of the positioning block is taken into account. The drive continues to run to the already computed target position.

Note: The chain dimensional reference is guaranteed.

Example Interrupted relative positioning block **with** residual path storage after jogging with target position = 600 **with overrunning the target position** while jogging.

Behavior The drive runs back to the target position set prior to the interruption.

Note: The chain dimensional reference is guaranteed.

Reference position The **last "End position reached" message** is used as reference position.

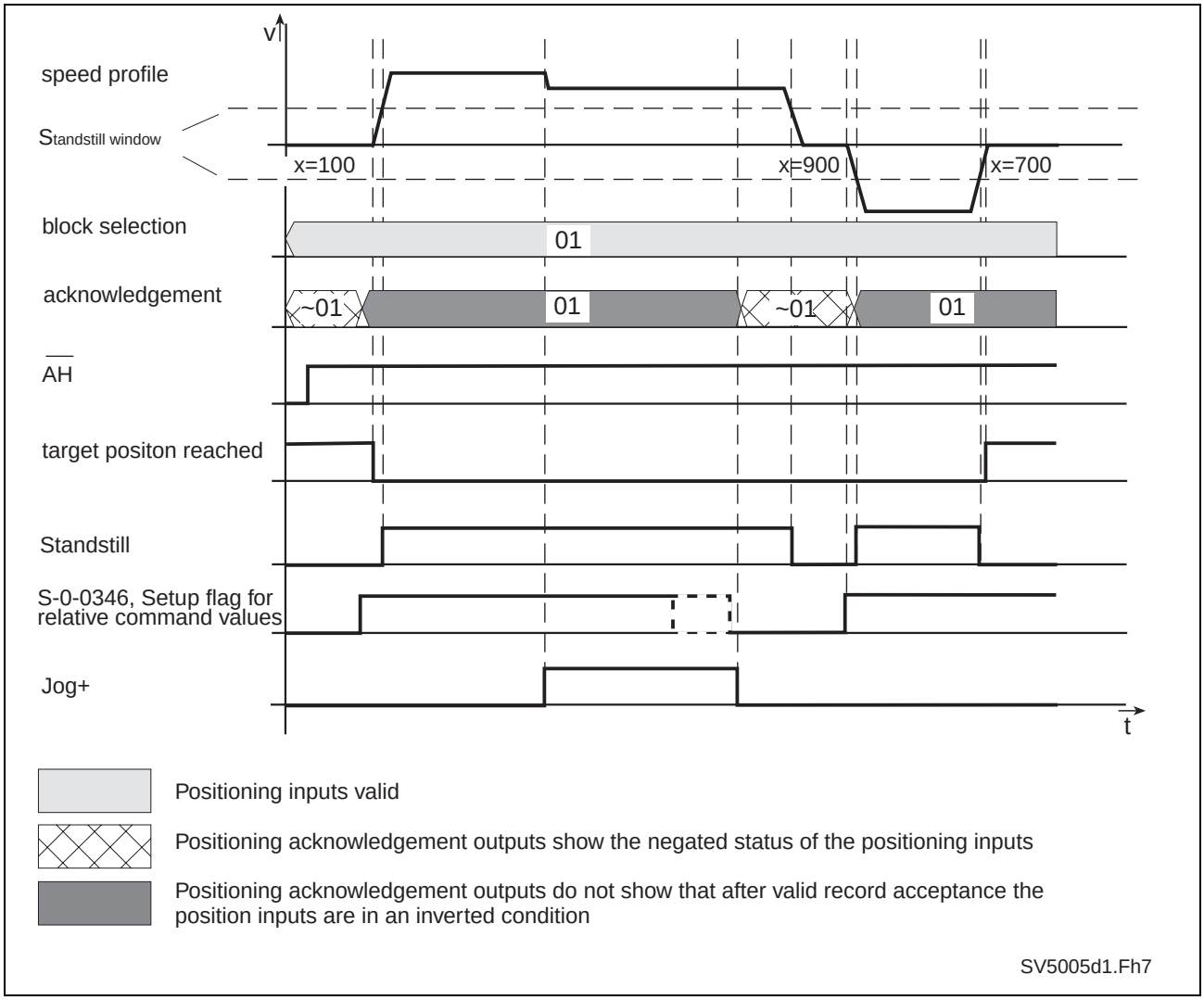


Fig. 7-21: Relative positioning block with residual path storage after jogging

Relative positioning block with residual path storage after switching drive controller control voltage on and off

If an **absolute encoder** is used then it is possible that the chain reference is retained after switching control voltage on and off. The previously computed target position is stored at power shutdown. The rest of the distance is traveled after the interrupted relative positioning block with residual path storage is activated.

Behavior If a **single turn encoder** is used, then the remaining path is discarded and added to the actual position.

Reference position

The **last "End position reached" message** is used as reference position.

Note: If a positioning block is not accepted then the drive behaves as if it had never been started.

Infinite running in a positive / negative direction

If an axis is to be run with defined speed, acceleration and jerk without a specific target position, then the travel block mode: **"Travelling in a positive direction"** or **"Travelling in a negative direction"** must be specified. The drive runs in the set direction until the start signal is reset or the position limit value or the travel range limit switch is reached.

The set target position is not used in this positioning mode.

Parameter **P-0-4019, Process block mode** =

- 4h travel in positive direction
- 8 h travel in negative direction

See also section: Jogging

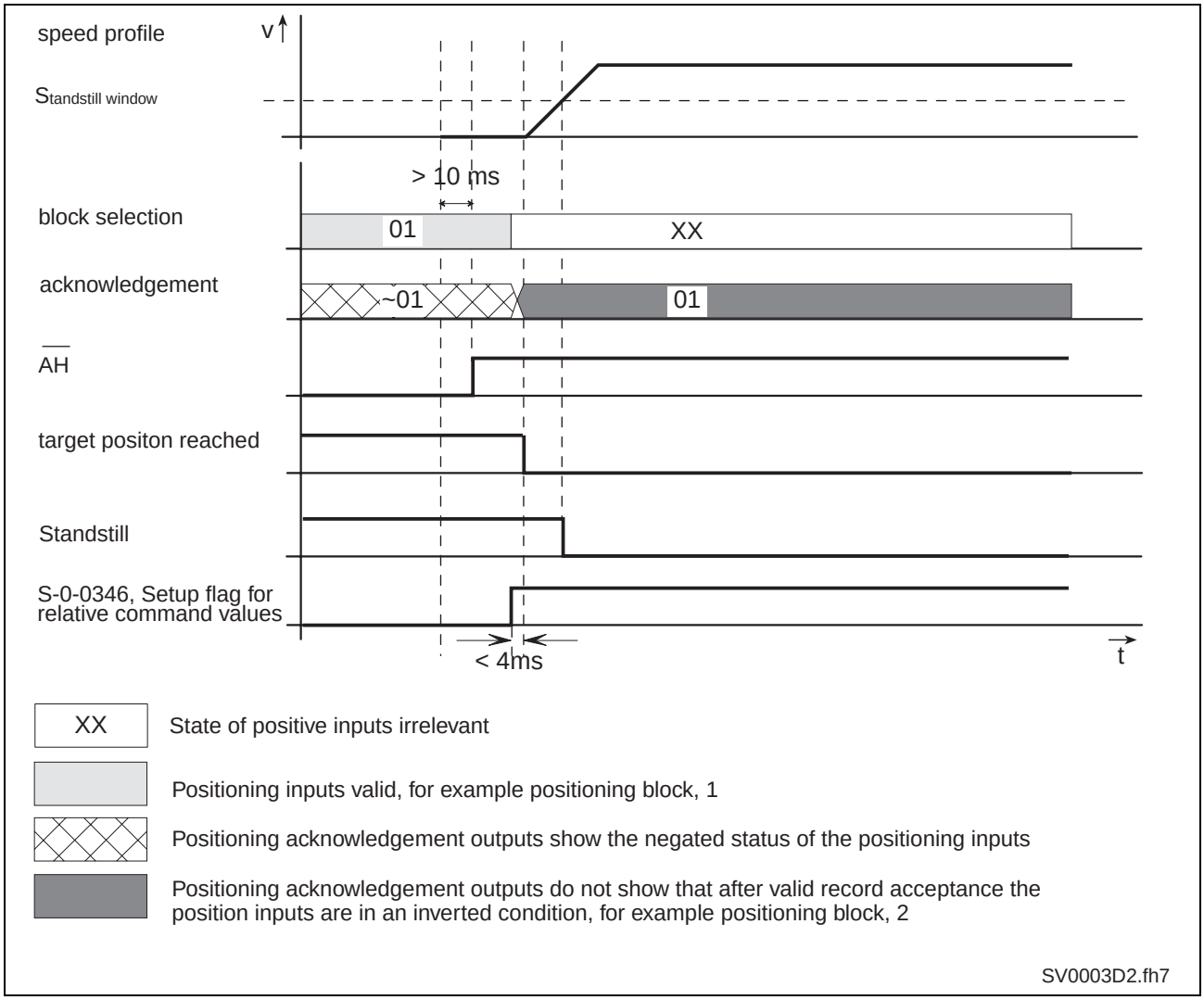


Fig. 7-22: Example: Infinite travel in positive / negative direction

Following block processing

Selecting and activating a following block

Selecting and activating a block with following block is performed in the usual manner. The following block is that block with the next highest block number. A following block can also have a following block so that after a start block up to 63 following blocks can be set. The potential following block of the block with number 63 is block 0.

Conditions to continue in following block mode

There are **two possibilities** for continuing block mode. These are also broken down into:

1) Position-dependent continue block mode

With position-dependent continue block mode, the following block is switched into at the target position of the start block.

There are **three different** types of block transitions:

a) Block transition at old positioning speed (Mode 1)

P-0-4019, Process block mode =11h: absolute block with following block

P-0-4019, Process block mode =12h: relative block with following block

P-0-4019, Process block mode =14h: infinite block in positive direction with following block

P-0-4019, Process block mode: infinite block in negative direction with following block

In this mode, the target position of the start block is run through at the speed of the start block and then switched to the positioning speed of the

Definition

With relative and absolute blocks with sequential processing, the drive runs in the direction of the target position. As soon as the **target position is exceeded**, it switches to the **next block n+1.**
With infinite blocks, the drive runs positive or negative. As soon as the **target position is exceeded**, the drive switches to **next positioning block n+1.**
"n" represents the block currently in process.

Note: If the target position is not in travel direction, then it will never be reached. The drive does not switch to the next positioning block.

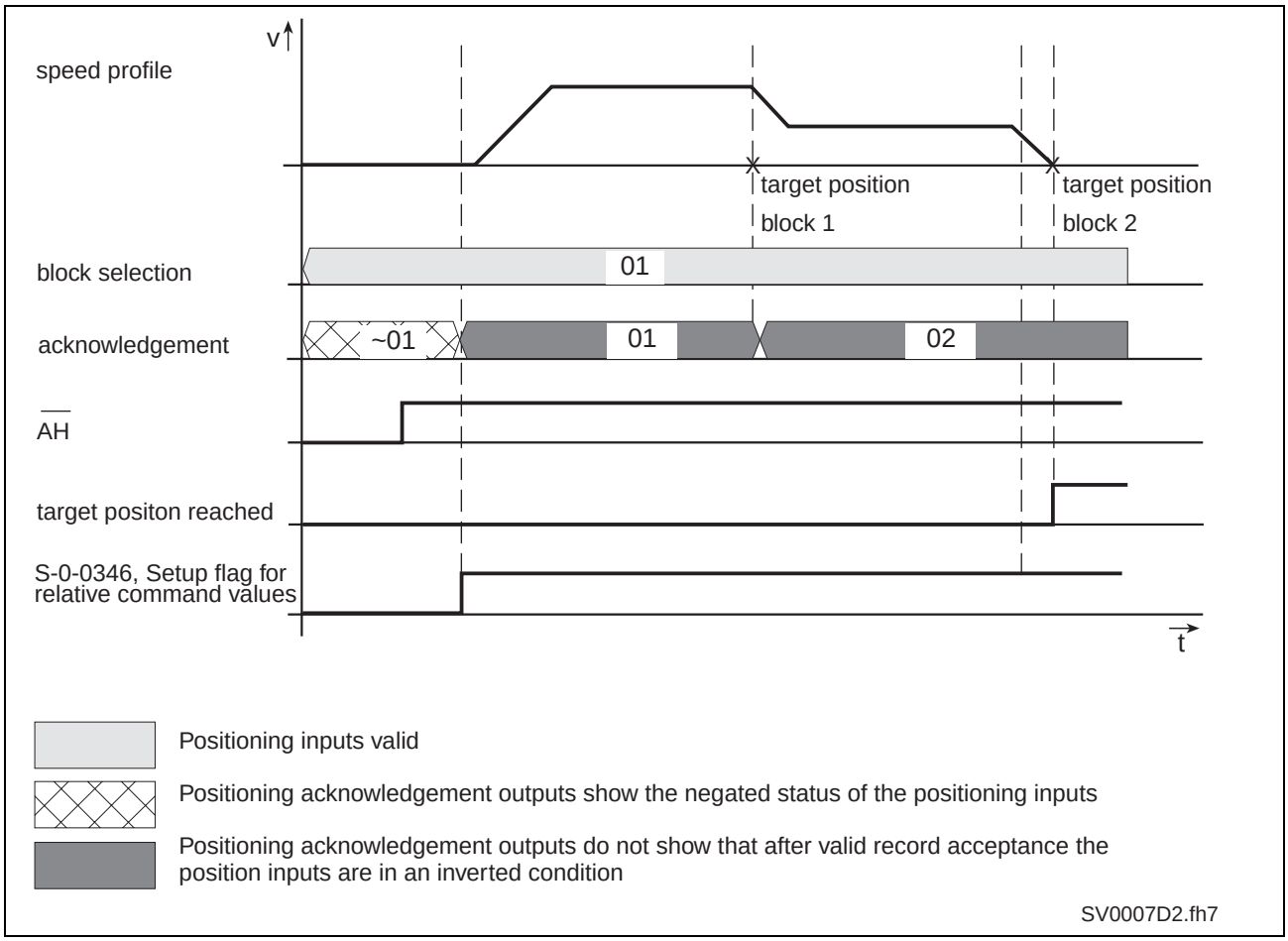


Fig. 7-23: Example: Position-dependent block commutation (mode 1)

b) Block transition with new positioning speed (Mode 2)

P-0-4019, Process block mode =21h: absolute block with following block

P-0-4019, Process block mode =22h: relative block with following block

P-0-4019, Process block mode =24h: infinite block in positive direction with following block

P-0-4019, Process block mode =28h: infinite block in negative direction with following block

In following block mode 2, position-depenent block commutation means that the target position of the start block is run through at the positioning speed of the following block.

Definition

The drive runs in the direction of the target position $\mathbf{X_n}$ (with infinite blocks in set direction) set in **current position block n**. As the drive approaaches $\mathbf{X_n}$, there is acceleration $\mathbf{a_n}$ to the **next** positioning speed $\mathbf{v_{n+1}}$ so that the speed $\mathbf{v_{n+1}}$ can be achieved prior to target position $\mathbf{X_n}$.

The switch to the next positioning block does not occur here either until the next target position is overrun.

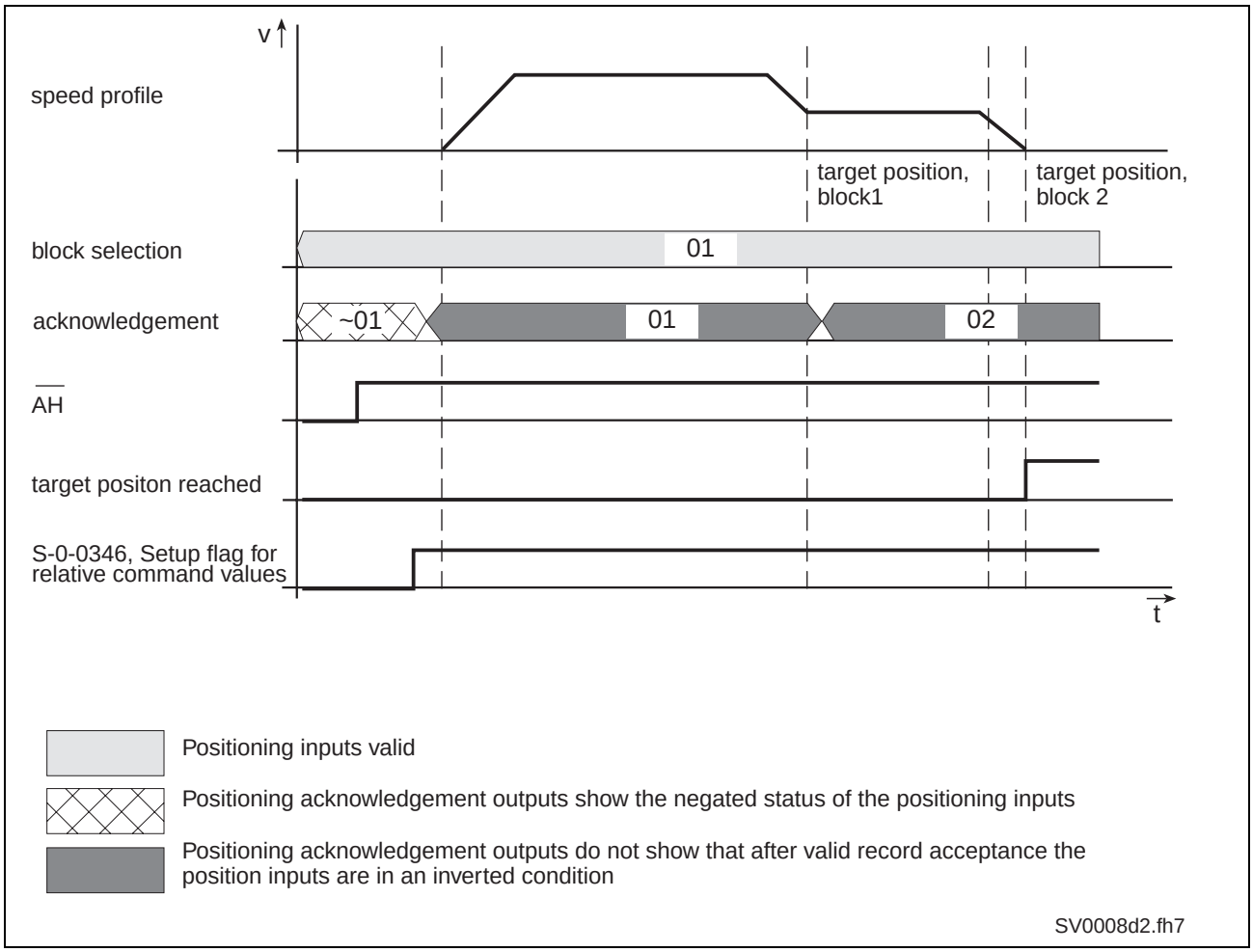


Fig. 7-24: Example: Position-dependent block commutation (Mode2)

c) Block transition with intermediate halt

P-0-4019, Process block mode =41h : absolute block with following block

P-0-4019, Process block mode =42h : relative block with following block

With block commutation with intermediate stop, the drive positions at the target position of the start block. Once the position command is at the target position, the following block is automatically started without a new start signal generated externally.

Definition As the drive approaches the target position, the drive is decelerated to speed 0 at the target position and then accelerated to the new positioning speed.

Note: Commutation takes place if the internal command value generator reaches the target position. Very small jerk values result in a creeping to target position which is like a dwell time.

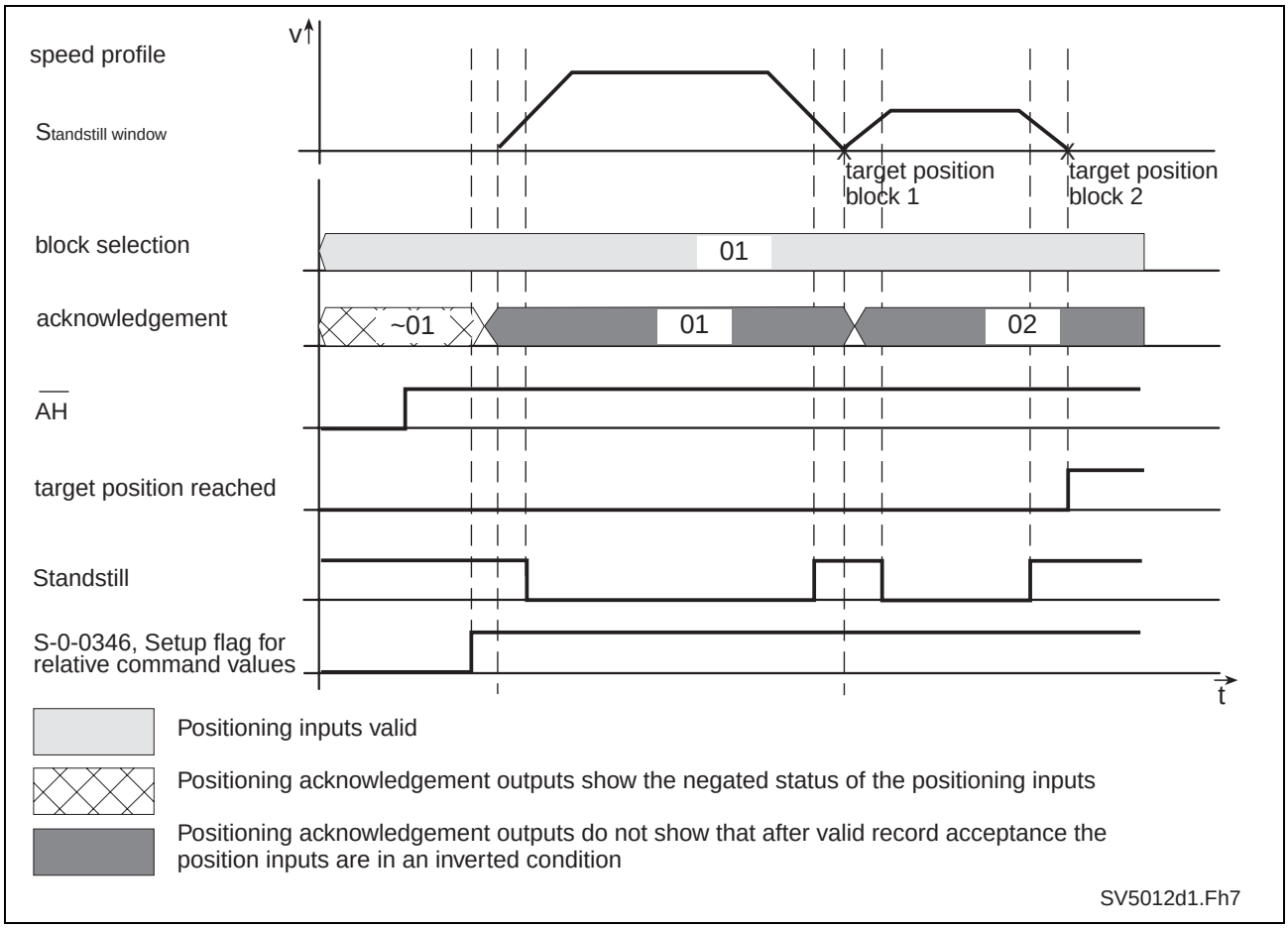


Fig. 7-25: Example: Following block commutation with target position with intermediate halt

Note: This mode should be used if there is a change in direction with two sequential following blocks within one following block change. Otherwise, the position at which the direction is to be changed will be overrun.

2) Switching signal dependent block commutation

P-0-4019, Process block mode = 81h: absolute block with following block

P-0-4019, Process block mode = 82h: relative block with following block

P-0-4019, Process block mode = 84h: infinite block in positive direction with following block

P-0-4019, Process block mode = 88h infinite block in negative direction with following block

Block commutation to a block with the next highest block number is triggered with an externally applied switching signal.

Switching with cams

The switching signal dependent block commutation makes a transition to a following block possible based on an external switching signal. As signal input the two following block inputs are available.

The state of the hardware signals is shown in parameter **P-0-4057, Positioning block, input linked blocks**.

Definition

The drive switches to the **next travel block** n+1 as soon as the input for the **following block cam 1** goes from **0->1**. If the target position is not reached then the new positioning block is switched into while travelling.

The drive switches to the **penultimate travel block** n+2 as soon as the input for the **following block cam 2** goes from **0->1**. If a following block cam is actuated during this run, then the drive switches to the positioning block after the next.

Reference position

A following relative positioning block references that position at which the following block cam was switched.

Note: The following block cams are checked ever 2 ms. The accuracy of the position detected therefore depends considerably on the speed at the time of overrun.

Allocation table for cams

Cam 2	Can 1	Drive reaction
0	0	drive runs to target position of block n
X	0->1	block n+1 started
0->1	X	block n+2 started

Fig. 7-26: Drive reaction with different switching signal sequences

X = Don't Care

n = positioning block selected via parallel inputs or parameter **P-0-4026, Process block selection**.

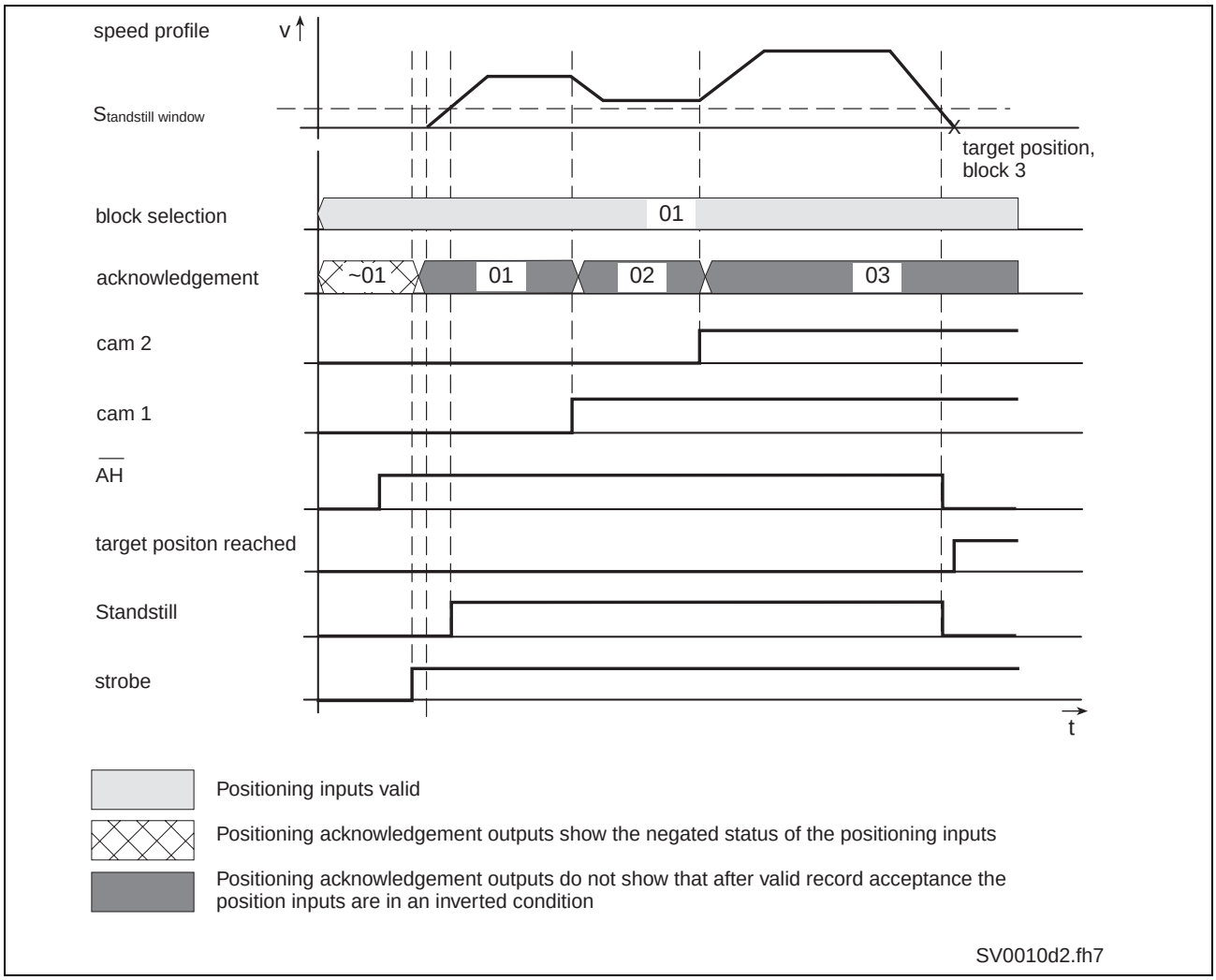


Fig. 7-27: Example: switching signal dependent block commutation

No switching signal for block commutation

If the start block of a switching-signal dependent following block is an absolute or relative positioning block, then the drive positions on target position if the switching signal for block commutation does not arrive. The drive thus generates the message "End position reached" after the following block chain is completed. If a switching signal is applied during the course of processing, then the drive will execute the following block.

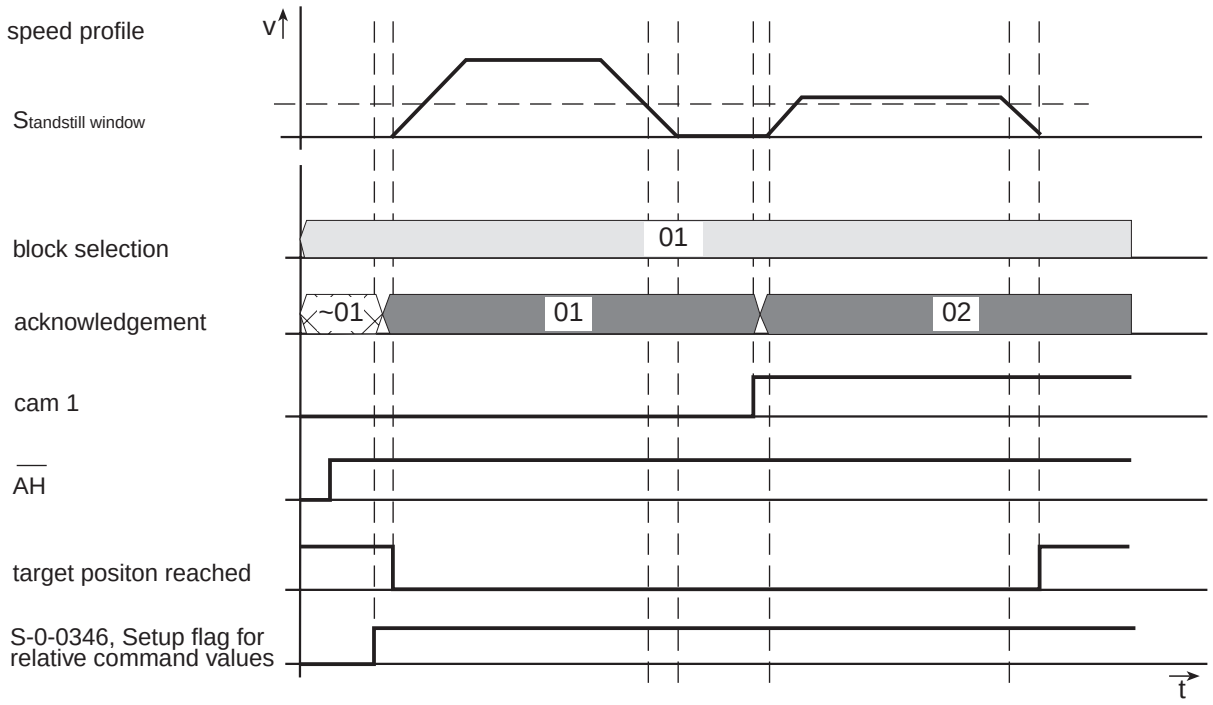


Fig. 7-28: Example: Switching-signal dependent block expansion (behavior with no switching signal)

Note: All four commutation conditions are constantly queried and evaluated to be able to switch to the correct following block even after the following block chain is interrupted. Only the first commutation conditions occurring during a break is recognized however. All others are not taken into account!

Interrupting a following block chain

An interruption can occur with

- a removal of the drive enable
- or a removal of the drive start signal.

Depending on the block type of the following block sequence that was interrupted and the events causing this interruptioin, the following block chain is processed differently after a restart.

Note: In following block mode only relative positioning blocks with residual path storage can be used as otherwise the chain dimension reference will be lost.

Interrupting a following block chain by selecting the same block number

Given an interruption (e.g., with drive halt), a restart will end the following block chain.

Reference position

The reference position is the original start position of the block chain.

The chain is retained as only absolute and relative positioning blocks with residual path storage are used in following block mode!

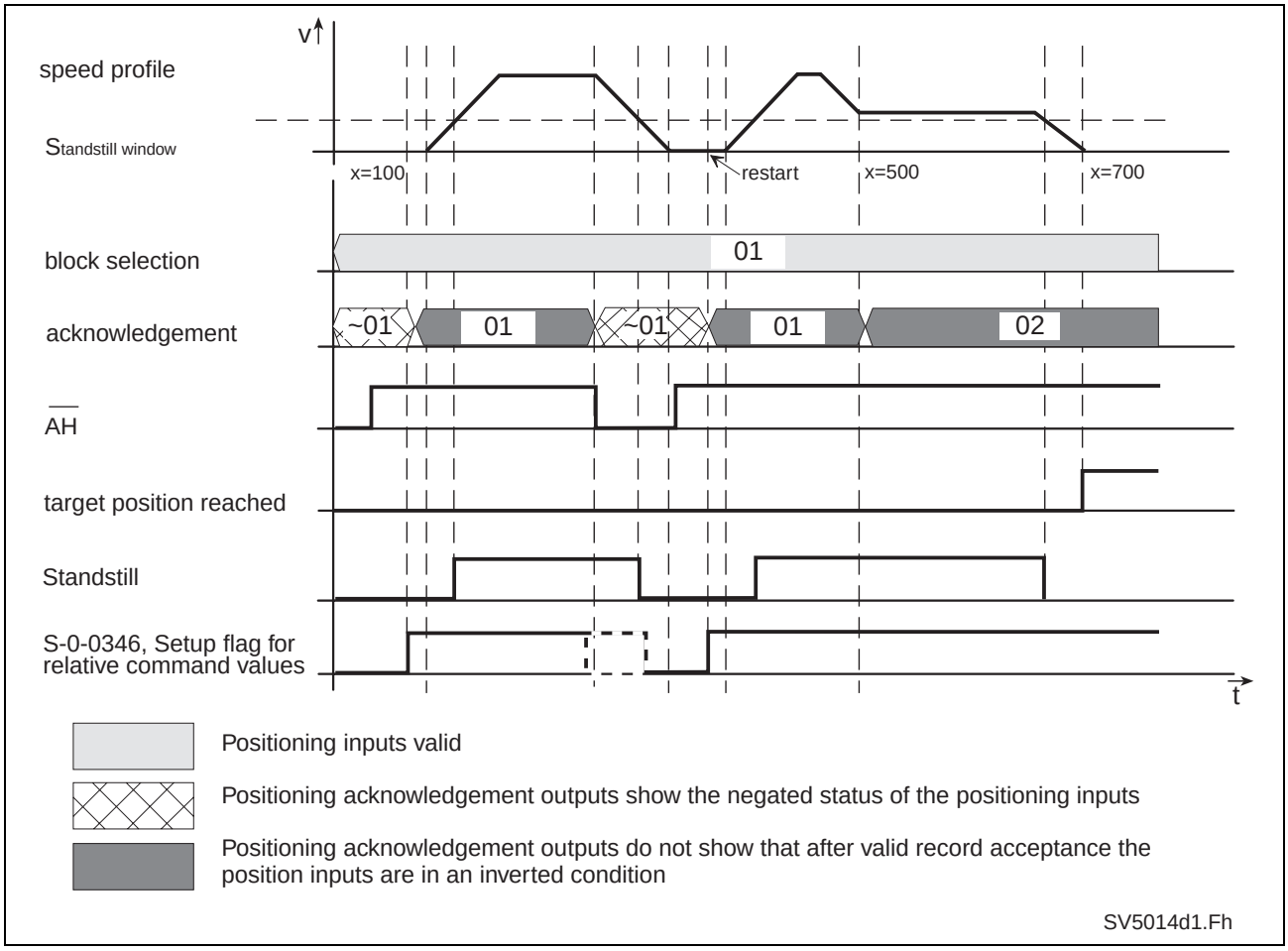


Fig. 7-29: Example: Following block interrupt with same block selected

Changing into jog mode

Note: Given a change into a different mode with an interrupt, the previously interrupt chain is completed upon restart unles a new block is selected. Given a following block with commutation due to target position means that only the overruning of the target position of the current position block will be detected. The following block is completed from this position. The commutation conditions due to switching signals is always detected.

Terminating a following block chain and selecting a new block number

If a **new block number** is selected during an interruption (e.g., with drive halt), then the previously interrupted following block chain is **not completed** after a restart. Instead the current block is executed.

Reference position

Current actual position value.

Note: The chain dimension reference is lost if the following block is interrupted.

The conditions for the interruption of following blocks also apply after the control voltage is switched off if an absolute encoder is used.

Interrupting a following block chain with absolute following blocks

An interuption with absolute positioning blocks represents no problem as the absolute dimension is always guaranteed.

.. when selecting a new block number

If a new block number is selected with an interruption, then the interrupted following block **is not completed** if **S-0-0346 Setup flag for relative command values,** is toggled. Instead, the current block is executed.

.. with selecting the same block number

If the same block number is selected with an interruption, then the interrupted following block **is completed** if **S-0-0346, Setup flag for relative command values** is toggled.

Parametrization notes for positioning blocks

Taking drive limits into account

When parameterizing following blocks, the maximum values of the drive must be taken into account.

These are:

- maximum accel capability
- maximum speed (mains voltage dependent)

If blocks are parametrized that demand values greater than the maximum value of the drive, then this will generate an excessive lag error. The drive will signal error **"F228 Excessive deviation"** to indicate that it cannot comply with the position command value.

Minimum values for accel and jerk

General information

Accel values that are too small can also cause problems which is why the following should be taken into account with fixing the positioning blocks.

- **Minimum accel value**

$$acceleration > \frac{\text{speed difference}^2}{2t\ \text{arg}\,et\,positiondifference} = \frac{\left(v_{n+1} - v_n\right)^2}{2 \cdot \left(X_{n+1} - X_n\right)}$$

X_{n+1} = t arg *et*position of the block n + 1
v_n = b*lockspeed* n
v_{n+1} = b*lockspeed* n + 1

Fig. 7-30: Minimum accel value with following block mode (translatory)

Note: The above relationship applies to a very large jerk, i.e., a jerk filter that has been switched off (= 0). If such a filter is used, then the computed values are doubled. The stretch to be run with a block and its speed are generally fixed in percents. If the minimum accel value computed already causes the maximum value of the previous section to be exceeded, then a lower positioning speed must be selected.

- **Minimum jerk value**

If accel values are parametrized too small, then this could mean that the parametrized speed is not reached. What results is a "Triangular mode".

Directional change within a following block chain

Note: If a directional change takes place when changing block n to block n+1 of a following block, then mode "Switching at target position with halt" should be used to reverse the direction without overshoot.

Explanation

Following block n with mode 1 following by **following block with intermediate halt**, because a **change in direction** occurs when changing from block n to block n+1.

This means there is a sign change for the speed for target position n+1. If the accel parametrized in block n+1 is too small to decel within the path difference = X_{n+1}-X_n from speed v_n to value 0, then the parmetrized target position X_{n+1} will be overrun.

This can cause software or hardware limit switches to trigger.

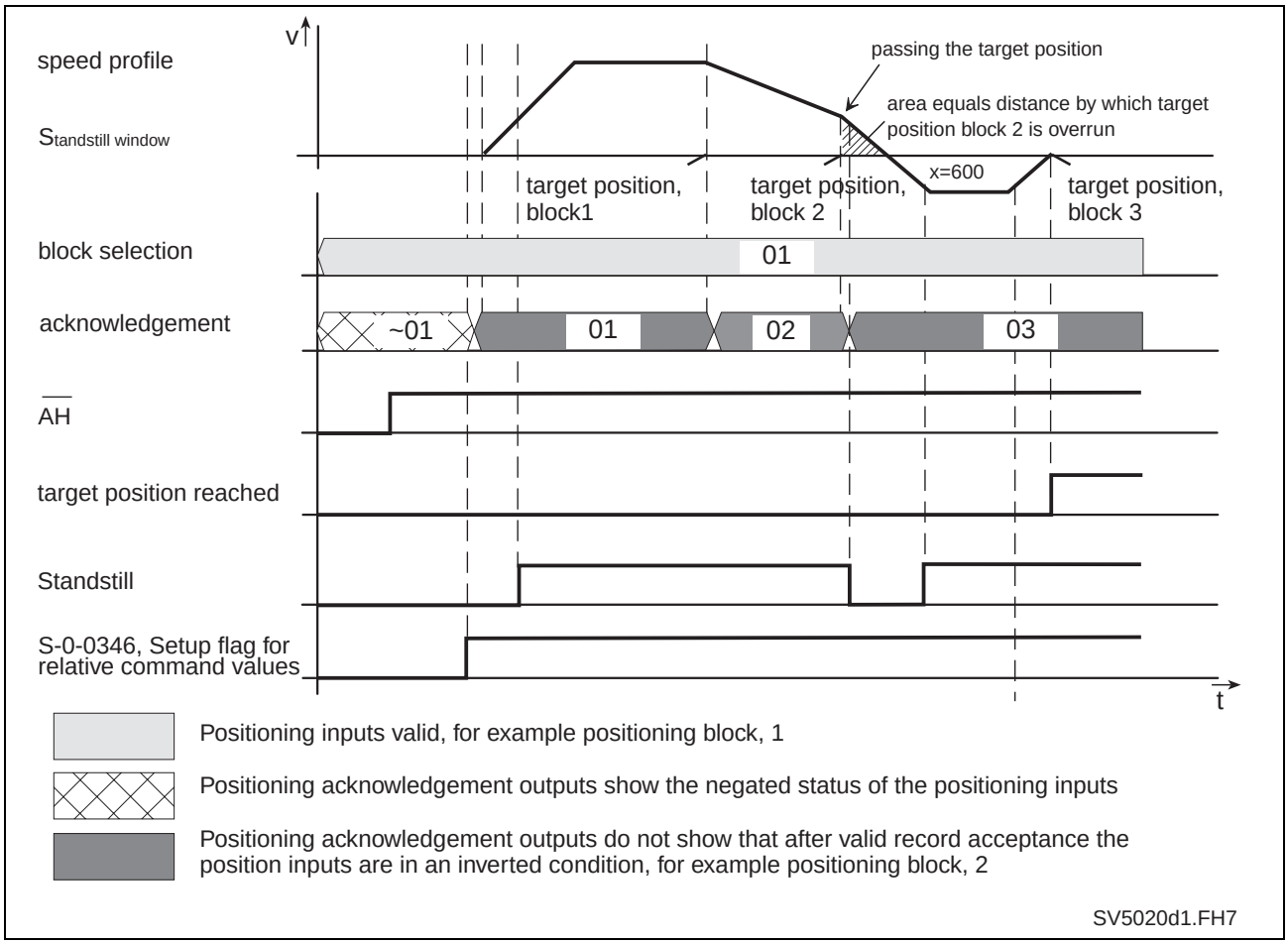


Fig. 7-31: Parametrizing a following block with directional change

Note: In this case it is necessary to take the rule of thumb into account for minimum acceleration to avoid overshooting of position!

Acknowledge positioning block selected

Acknowledge with drive enable removed

After removing the drive enable the **last accepted positioning block** is output. If the drive is at the target position of the last positioning block, then the message "**end position reached**" is additionally generated.

Note: The message "End position reached" is retained even after the drive enable signal is removed.

The example below shows the same absolute positioning block being started once more time.

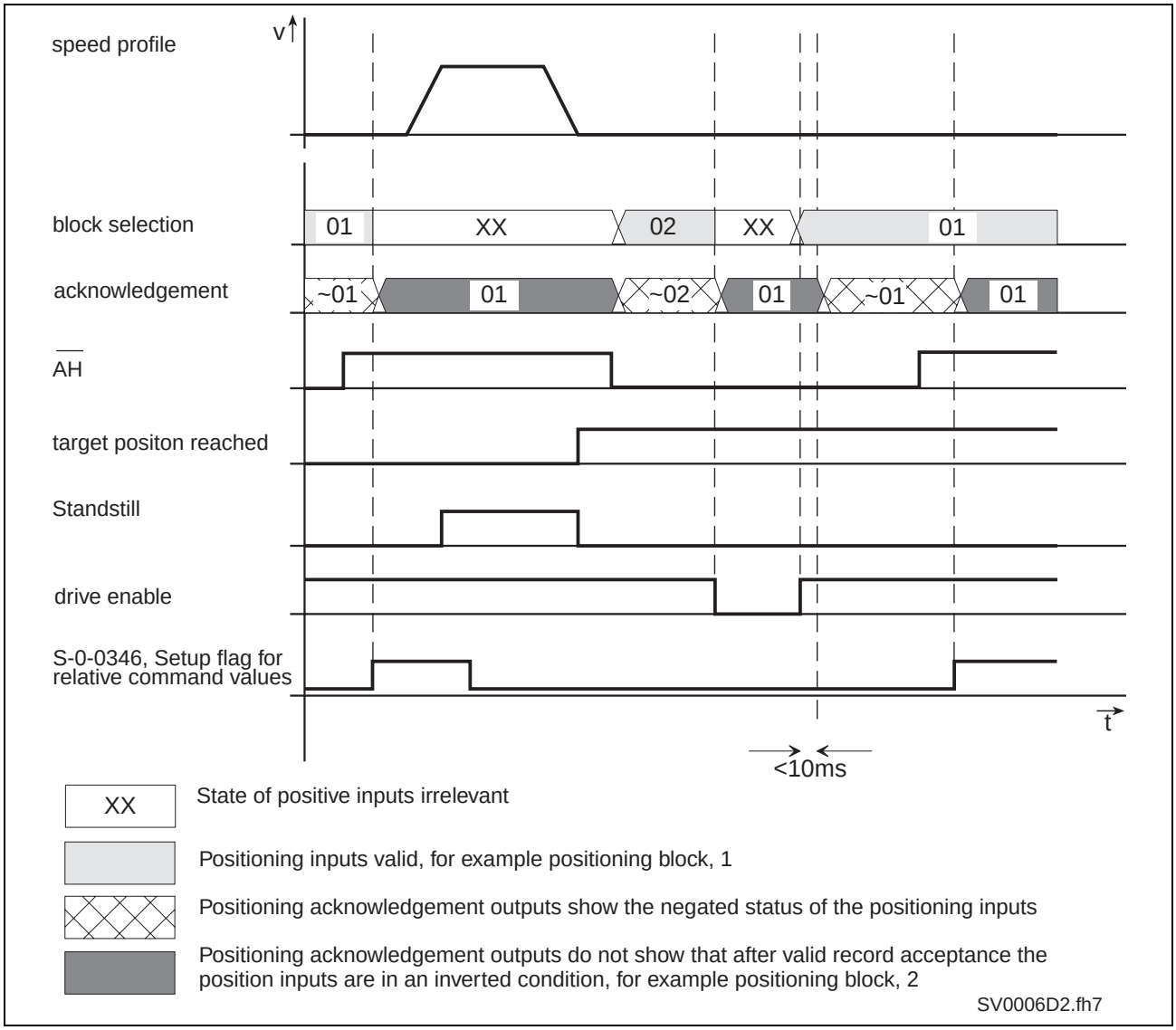


Fig. 7-32: Acknowledging and signalling **"End position reached"** after drive enable removed

Acknowledge with control voltage interrupt

If the control voltage is switched off, then the last positioning block secured is stored in parameter **P-0-4052, Positioning block, last accepted.** This means that after powering up the last positioning block is output.

Absolute encoder

If an **Absolute encoder** is used, then it can be decided after the control voltage is switched off and on whether the drive is at the target position of the last positioning block (IN-POS message active).

The INPOS message is fixed as soon as the drive is ready to operate again (bb contact closed).

Singleturn encoder

If a **Singleturn encoder** is used, then the IN-POS message is not clearly defined after a power interrupt until the first target position is approached or referenced.

Note: The INPOS message is only retained if the axis is not moving during the interruption. If the axis is moved into the positioning window during the interruption, then the INPOS message will also be generated. After activating the drive enable, positioning block acknowledge changes to as described in "Acknowledge with drive enable removed".

Status Messages in "Positioning Block Mode"

In addition to the messages lised in section: "Status messages during drive-internal interpolation", the following status messages are also generated in positioning block mode:

- **End position reached**, Bit 12 of **S-0-0182, Manufacturer status class 3** is "1", it applies if:
  message "**In-target position**" (S-0-0182, Bit10) is active and no slave block has been selected.

Diagnostic messages

- **E248 Interpolation acceleration = 0**
- **E249 Positioning velocity S-0-0259 > S-0-0091**
- **E253 Target position out of travel range**
- **E254 Not homed**
- **E255 Feedrate-override S-0-0108 = 0**
- **E258 Selected process block is not programmed**
- **E264 Target position out of num. range**

7.8 Operating Mode: Jogging

Operating mode is used to run an axis in "Manual mode", i.e., without the use of the control program.

Pertinent Parameters

- **P-0-4030, Jog velocity**
- **P-0-4056, Jog inputs**
- **S-0-0260, Positioning Acceleration**
- **S-0-0193, Positioning Jerk**

Note: The parameters for the jog inputs are already present with Sercos and fieldbus interfaces even though hardware inputs are not.

Additional parameters

- **S-0-0403, Position feedback value status**
- **S-0-0055, Position polarities**
- **S-0-0049, Positive position limit value**
- **S-0-0050, Negative position limit value**

Note: In the case of a fieldbus interface, it is possible to switch to jog mode by setting a bit in **P-0-4076, Fieldbus control word**.

How it works

Activating the operating mode ogging:

The jogging mode is active with a fieldbus interface if such has been selected via the control word.

The jog direction can be read out of parameter P-0-4056.

Functional Sequence of operating mode jogging

Upon activation of the mode, the drive runs position controlled while maintaining the:

- speed limit value (**P-0-4030, Jog velocity**),
- acceleration limit value (**S-0-0260, Positioning Acceleration**)
- jerk limit value (**S-0-0193, Positioning Jerk**).

The Jogging direction is fixed in parameter **P-0-4056, Jog inputs**.

Jog inputs	Drive	Display
00b	stand still	AF
01b	moving forward	JF
10b	moving backward	Jb
11b	stand still	AF

Fig. 7-33: Relationship of jog input to travel direction

The drive positions itself at the relevant position limit (S-0-0049 or S-0-0050) if:

- position limit monitor is activated
  (**S-0-0055, Position polarity** Bit 4 = 1)
- and the drive has been homed (**S-0-0403, Position feedback value status**
  Bit 0 = 1)

Note: If one of the above conditions has not been made, then the drive continues to run infinitely in the set direction.

Note: The speed at which the drive moves when jogging can be influenced with the help of the **Override function**. Function **Positioning at limited speed** also has an immediate effect on the jog speed.

Diagnostic Messages

Warning "**E831 Position limit reached during jog**" is generated if the drive positions at the position limit value.

The warning is cleared:

- once the mode is changed and
- after jogging in the opposite direction.

8 Basic Drive Functions

8.1 Physical Values Display Format

Data exchange between the controller and the primary control system or user interface occurs by reading and writing controller parameters. Information about the unit and the number of decimal places (see also parameter) is necessary for interpreting the operating data of a parameter. The value of the operating data is produced from these data. The following illustration shows this with an example.

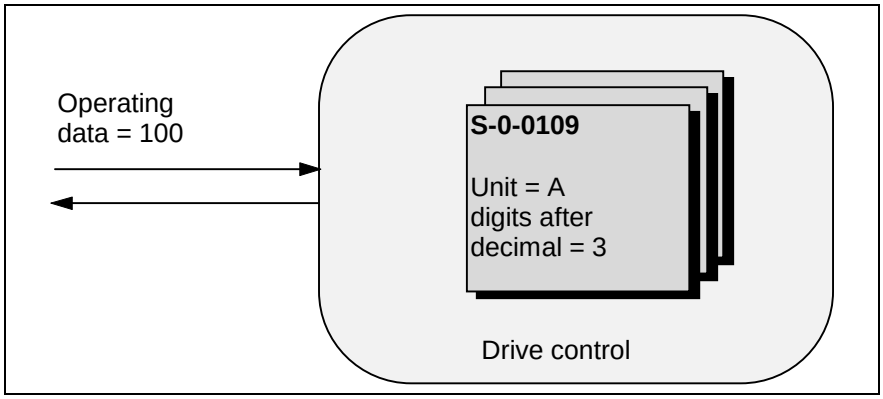


Fig. 8-1: Example for interpreting operating data in the drive

The combination of unit and number of decimal places is expressed with the term scaling.

The operating data of the parameter S-0-0109 is given the value 100 in the picture shown above. When combined, the unit A(mps) that belongs to this parameter and the number of decimal places produce the physical value **0.100 A**.

Each parameter can therefore be called up with a unit and the number of decimal places. The combination of these two criteria is united under the term **scaling**. When interpreting operating data, these must always be included in the analysis. Units and number of decimal places are listed along with all other parameter attributes in Supplement A, Parameter Description, for each parameter.

Adjustable Scaling for Position, Velocity, and Acceleration Data

The value of position, velocity, and acceleration data can be set by adjustable scaling.

The parameter scaling for

- position,
- velocity and
- acceleration data

can be adjusted. It can be set by the user with scaling parameters. It enables

1. the value of this data to be made compatible for exchange between control system and control drive, or, in other words, the data can be exchanged in the control system's internal format. The control system will not need to convert this data.

2. this data to conform to machine kinematics. Linear movements can be described with linear units, for example, and rotary movements can be described with rotary units.

It is possible to select between linear and rotary scaling, and preferred and parameter scaling, as well as between motor and load reference.

Linear - Rotary Scaling

Adjustable scaling allows either linear or rotary scaling to be selected. Linear motors normally use a linear scale. Rotary motors use either a rotary or linear scale if their rotary movement is converted into a linear movement (with a ball roll spindle, for example).

Preferred Scaling - Parameter Scaling

Adjustable scaling allows either preferred scaling or parameter scaling to be selected. If preferred scaling is selected, the appropriate scaling factor parameters and scaling exponent parameters in **S-0-0128, C200 Communication phase 4 transition check** are overwritten with preferred values. This sets a pre-defined scaling. The scaling factor parameter and the scaling exponent parameter are not entered. The concrete preferred scaling adjusts itself to the selection of linear or rotary scaling.

The following preferred scalings are available:

Physical Value:	Rotary Preferred Scaling:	Linear Preferred Scaling (mm):	Linear Preferred Scaling (Inch):
Position data	0.0001 Degrees	0.0001 mm	0.001 Inches
Velocity Data	0.0001 RPM, or 10^-6 Rev/s	10^ 6 m/min	10^-5 in/min
Acceleration Data	0.001 rad/s²	10^-6 m/s²	--

Fig. 8-2: Preferred scaling

Motor Reference - Load Reference

Either motor reference or load reference can be selected when adjusting the scaling.

load reference

With rotary load reference, the scaled data from the motor format is converted to the transmission output format with the transmission ratio **S-0-0122, Output revolutions of load gear** / **S-0-0121, Input revolutions of load gear**.

With linear load reference, the scaled data from the motor format is converted to feed constant format with the transmission ratio **S-0-0122, Output revolutions of load gear** / **S-0-0121, Input revolutions of load gear** and the feed constant **S-0-0123, Feed constant**.

The following restrictions apply in relationship to the motor type being used :

- Rotary motor reference cannot be set with linear motors.
- Linear motor reference cannot be set with rotary motors.

Display Format of Position Data

The scaling of drive controller position data is adjustable. This is done with the parameters

- **S-0-0076, Position Data Scaling Type**
- **S-0-0077, Linear Position Data Scaling Factor**
- **S-0-0078, Linear Position Data Scaling Exponent**
- **S-0-0079, Rotational position resolution**

This differentiates between linear and rotary scaling. **S-0-0079, Rotational position resolution** sets the rotary position scaling. **S-0-0077, Linear Position Data Scaling Factor** and **S-0-0078, Linear Position Data Scaling Exponent** set the linear position scaling.

The scaling type is set in **S-0-0076, Position Data Scaling Type**.

The parameter is defined as follows:

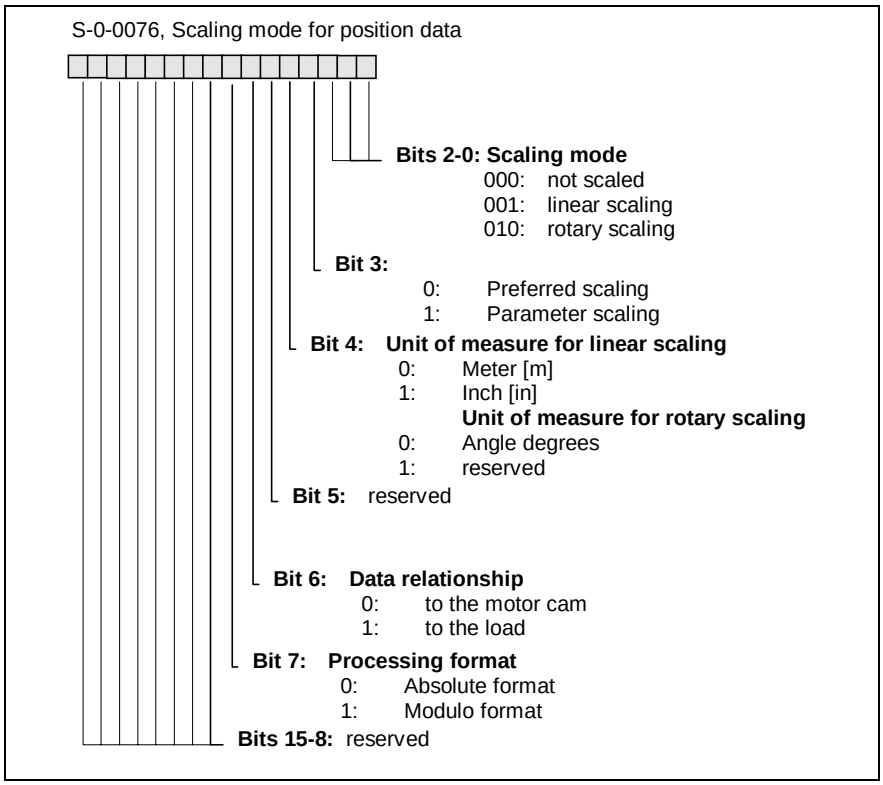


Fig. 8-3: S-0-0076, Position Data Scaling Type

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication phase 4 transition check**, and the command error message **C213 Position Data Scaling Error** is generated, if necessary.

Velocity Data Display Format

The scaling of the drive controller's velocity data is adjustable.

This is done with the parameters

- **S-0-0044, Velocity data scaling type**
- **S-0-0045, Velocity data scaling factor**
- **S-0-0046, Velocity data scaling exponent**

The scaling type is set in **S-0-0044, Velocity data scaling type**. The parameter is defined as follows:

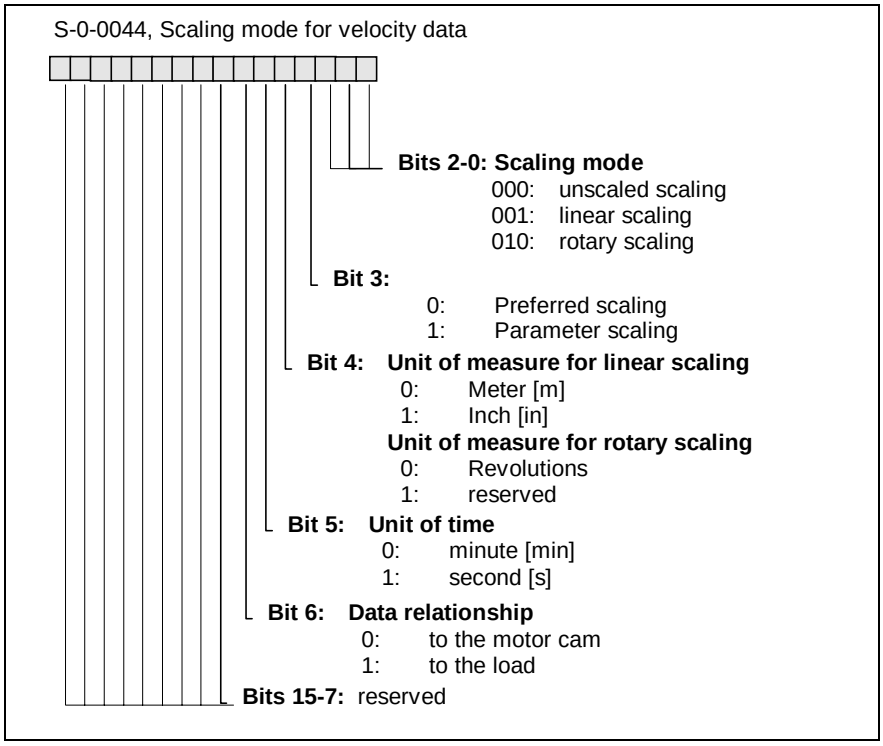


Fig. 8-4: S-0-0044, Velocity data scaling type

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication phase 4 transition check,** and the command error message **C214 Velocity Data Scaling Error** is generated, if necessary.

Acceleration Data Display Format

The scaling of the drive controller's acceleration data is adjustable.

This is done with the parameters

- **S-0-0160, Acceleration data scaling type**
- **S-0-0161, Acceleration data scaling factor**
- **S-0-0162, Acceleration data scaling exponent**

The scaling type is set in **S-0-0160, Acceleration data scaling type**. The parameter is defined as follows:

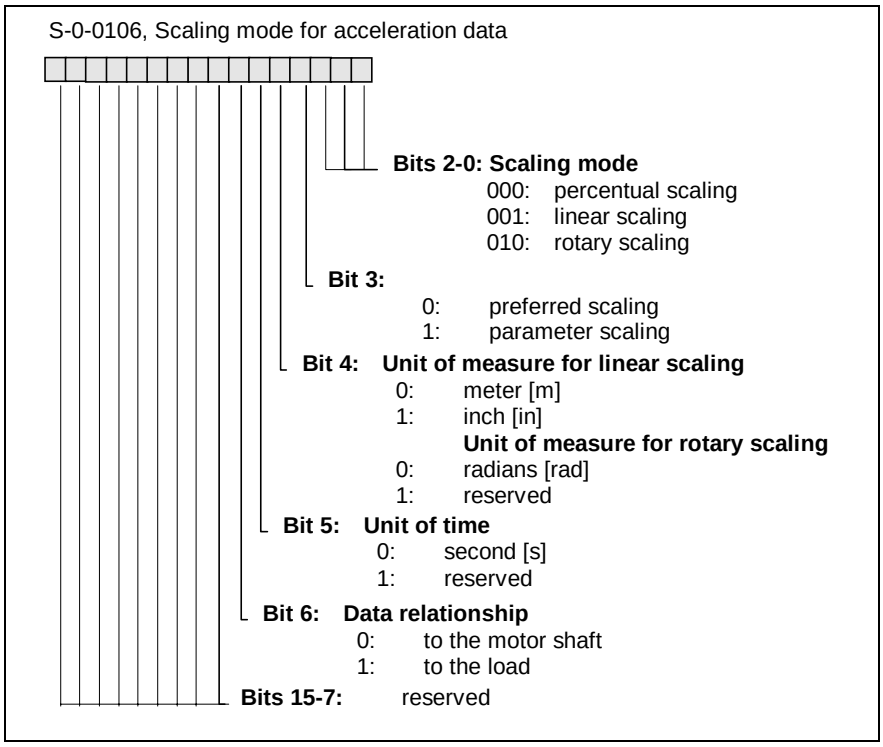


Fig. 8-5: S-0-0160, Acceleration data scaling type

The actual scaling type is set in bit 0…2.

The scaling type setting is checked for plausibility in **S-0-0128, C200 Communication phase 4 transition check,** and the command error message **C215 Acceleration Data Scaling Error** is generated, if necessary.

Command Polarities and Actual Value Polarities

The drive-internal polarities of position, velocity, torque/force and actual value are fixed. The following applies:

Motor type:	Drive internal positive direction definition:
Rotary motors	Clockwise rotation facing the motor shaft
Linear motors	Move in the direction of the frontal area of the power cable on the primary component

Fig. 8-6: Drive internal positive direction definition

The positive direction is specified by the manufacturer for MHD-, MKD and MKE motors. Asynchronous motors, linear synchronous motors and MBS motors should be set in this direction during installation. (see "other motor encoder characteristics"). The command polarity and actual value polarity of the drive is thereby fixed.

If the drive's definition of the positive direction does not conform to the requirements of the machine, the parameters

- **S-0-0055, Position Polarity Parameter**
- **S-0-0043, Velocity polarity parameter**
- **S-0-0085, Torque/Force polarity parameter**

can invert the command and actual value polarities.

Note: If the polarity needs to be changed, all 3 parameters should always be inverted at the same time, so that the polarities of the position, velocity and torque have the same sign.

The following illustration shows the operating characteristics of the polarity parameters.

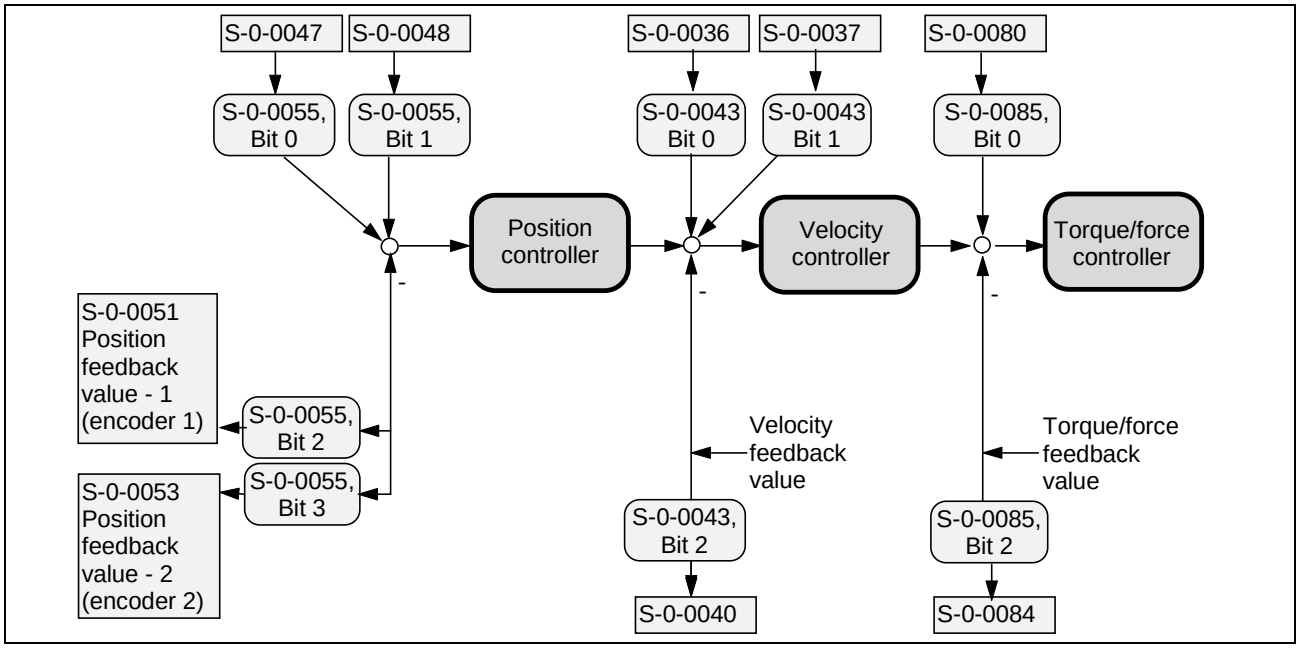


Fig. 8-7: Polarity parameter operating characteristics

The polarity parameters affect only the display values, not the control feedback values.

The drive software only allows all bits within a polarity parameter to be inverted. If bit 0 is inverted, all other bits of the parameter are also inverted. This protects against the danger of adding positive feedback into the control loop (command and actual values separate) due to incorrectly set command and actual value polarities.

Mechanical Transmission Elements

Mechanical transmission elements are gearboxes and feed mechanisms between the motor shaft and the load. Entering these data is necessary for the load to convert the position, velocity, and acceleration physical values, if these are scaled for the load. (See also "Adjustable Scaling for Position, Velocity, and Acceleration Data".) To see if this parameter has been entered correctly, move the shaft and compare the path followed with the position feedback value and the path actually taken.

Transmission Ratio

The transmission ratio can be determined with the parameters

- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**

The ratio between transmission input and transmission output is parameterized here.

Example:

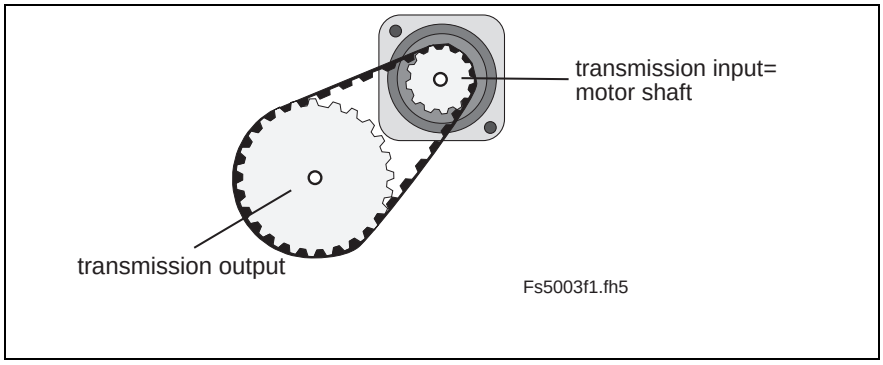


Fig. 8-8: Transmission ratio parameterization

In the illustration above, 5 transmission input revolutions (= motor revolutions) were equivalent to 2 transmission output revolutions. The proper parameterization for this would be :

S-0-0121, Input revolutions of load gear = 5

S-0-0122, Output revolutions of load gear = 2

Feed Constant

The feed constant defines which linear path the load should follow per transmission output revolution. It is specified in the parameter **S-0-0123, Feed constant**.

The value programmed here is used along with the transmission ratio for converting the position, velocity, and acceleration data from motor reference to load reference.

Example:

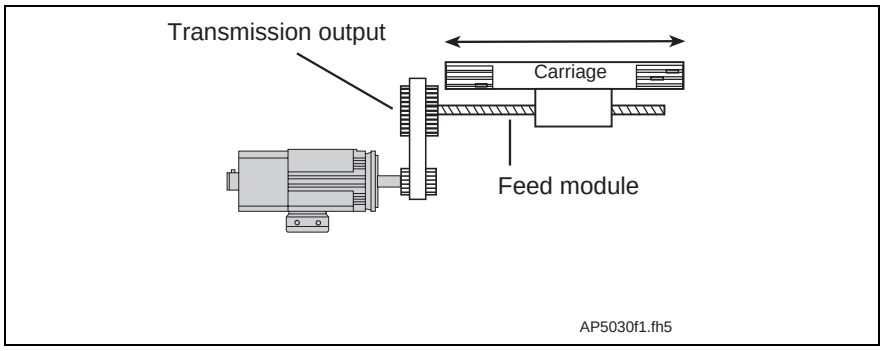


Fig. 8-9: Feed constant parameterization

In the illustration above, the feed module would cover 10 mm per transmission output revolution. The proper parameterization for this would be :

S-0-0123, Feed Constant = 10 mm/Rev

Modulo Feature

When the modulo function is activated, all position data are displayed in the range 0... (modulo value). Thus it is possible to implement an axis which can move infinitely in one direction. There is no overrunning of the position data.

The modulo value is set with the parameter **S-0-0103, Modulo Value**.

The modulo function is activated by the parameter **S-0-0076, Position Data Scaling Type**.

(See also "Display Format of Position Data".)

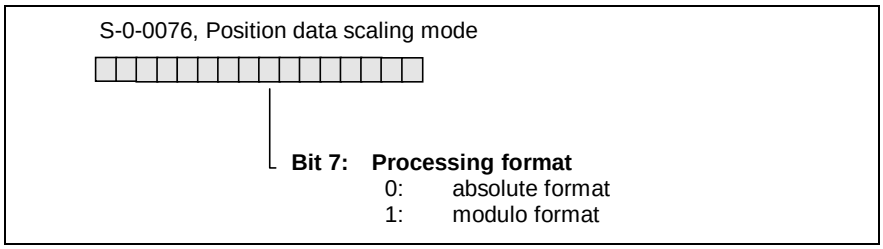


Fig. 8-10: Setting absolute format - modulo format

Note: Modulo processing of position data to is only allowed with rotary motor types. This is checked in **S-0-0128, C200 Communication phase 4 transition check** and acknowledged by the command error **C213 Position Data Scaling Error** if necessary.

The following illustration shows the difference in displaying the position data in absolute format and modulo format:

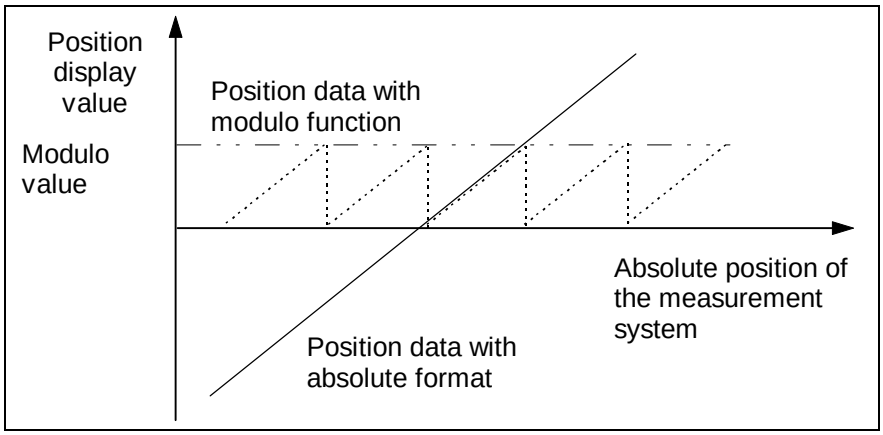

Position display value
Modulo value
Position data with modulo function
Absolute position of the measurement system
Position data with absolute format

Fig. 8-11: Display value of positions in absolute format and modulo format

Modulo Processing-Limiting Conditions

If modulo processing of position data is selected, in connection with

- the active operating mode and
- the selected position scaling

the following limiting conditions for error-free processing of the position data must be observed.

The limiting conditions are as follows:

- The modulo range **S-0-0103, Modulo Value** may not be greater than half the maximum travel range. The maximum travel range depends on the motor feedback being used (see also "Drive-internal format of position data").
- If rotary or linear position scaling with load reference and without angle synchronization is used as the operating mode, the product of **S-0-0103, Modulo Value, S-0-0116, Resolution of motor feedback** and **S-0-0121, Input revolutions of load gear** must be smaller than 2^63.

If, in addition to this, an external measurement system is used, the additional requirements are:

- If rotary position scaling with motor reference and no angle synchronization operating mode is used, the product of **S-0-0103, Modulo Value**, **S-0-0117**, **Feedback 2 Resolution** and **S-0-0122, Output revolutions of load gear** must be smaller than 2^63.
- If rotary position scaling with motor reference and angle synchronization operating mode is used, the product of **S-0-0237, Slave drive 1 revs.**, **S-0-0117**, **Feedback 2 Resolution** and **S-0-0122, Output revolutions of load gear** must be smaller than 2^63.

Compliance with the limiting conditions is checked in **S-0-0128, C200 Communication phase 4 transition check**, and the command is terminated with the error **C227 Modulo Range Error** if necessary.

Processing Command Values in Modulo Format, Shortest Path - Direction Selection

The interpretation of position command values such as **S-0-0047, Position Command Value** and **S-0-0258, Target Position** when the modulo function has been activated is dependent on the selected mode.

The following possibilities exist:

- Shortest Path
- Positive Direction
- Negative Direction

Parameter **S-0-0393, Command value mode** is used to set the mode. This parameter is effective only if modulo format has been activated in **S-0-0076, Position data scaling type**.

The following settings can be entered:

S-0-0393 = 0 **Modulo Mode "Shortest Path"**

The next command value is reached with the shortest path. If the difference between two successive command values is greater than half of the modulo value, the drive moves toward the command value in the opposite direction.

S-0-0393 = 1 **Modulo Mode "Positive Direction"**

The command value is always approached in a positive direction, regardless of whether or not the difference between two successive command values is greater than half of the modulo value.

S-0-0393 = 2 **Modulo Mode "Negative Direction"**

The command value is always approached in a negative direction, regardless of whether or not the difference between two successive command values is greater than half of the modulo value.

8.2 Setting the Measurement System

The drive controller is equipped with two permanently installed encoder interfaces, i.e., X4 and X8.

The encoder interface 1 (X4) is designed so that the following encoder types can be evaluated:

Encoder interface 1:

- digital servo feedback (DSF, HSF)
- resolver
- resolver without feedback data memory

Encoder interface 2:

Using encoder interface 2 (X8) it is possible to evaluate the following encoder types:

- incremental encoder with sine signals 1Vss
- incremental encoder with square-wave signals (TTL)
- measuring system with EnDat interface
- gearwheel encoder with 1Vss signals

Both encoder interfaces can be used to connect either a motor or an optional encoder.

At which interface the motor encoder should be connected and what type it is is set in parameter **P-0-0074, Feedback type 1.**

If an optional encoder is also to be used, the parameter **P-0-0075, Feedback type 2** must be used to define encoder interface and encoder type.

The following table explains the relationship:

Measuring system type:	Interface	Value in P-0-0074/75
digital servo feedback or resolver	1	1
incremental encoder with sine signals from Heidenhain with 1V signals	2	2
Incremental encoder with square wave signals from Heidenhain	2	5
Encoder with EnDat-interface	2	8
gearwheel encoder with 1Vss signals	2	9
Resolver without feedback data storage	1	10
Resolver without feedback data storage + incremental encoder with sine signals	1 + 2	11
Hall encoder + square wave encoder	1 + 2	12
ECI encoder	1	13
Hall encoder plus sinus encoder	1 + 2	14

Fig. 8-12: Measuring systems > connections

The table illustrates that some combinations are not possible as each encoder interface is only physically present once.

To display the actual position value of the individual measuring systems, use parameters:

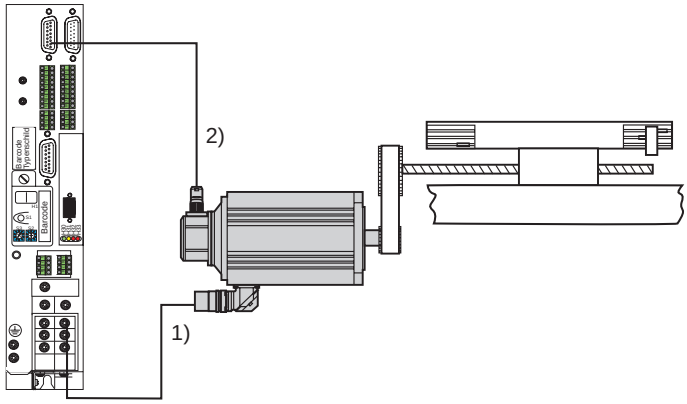
- **S-0-0051, Position feedback 1 value**
- **S-0-0053, Position feedback 2 value**

To set the absolute reference of actual position value 1/2 to the machine zero point, use commands

- **S-0-0148, C600 Drive controlled homing procedure command or**
- **P-0-0012, C300 Command 'Set absolute measurement'**

Motor Encoder

The measurement system which is directly coupled with the motor shaft without a gearbox between them is called the motor encoder. As the motor is usually coupled to the load with a mechanical gearbox and probably a feed unit, this is also called an indirect distance measurement. If a further measurement system is attached directly to the load, than this direct distance measuring (see "Optional Encoder"). Hereafter, are shown typical applications of indirect distance measuring.

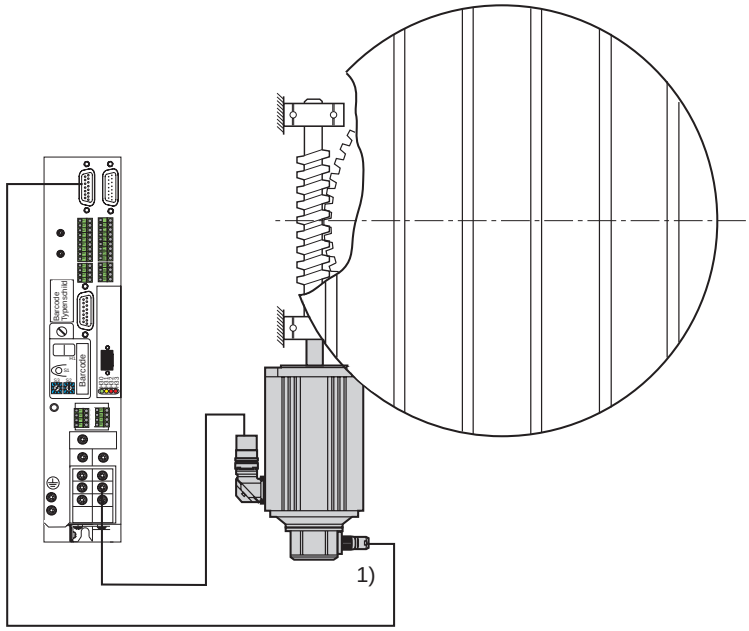


1) Power connectopn of motor

2) Connection of motor encoder (indirect position acquisition)

Ap5134f1.fh7

Fig. 8-13: Application: Motor encoder with linear servo axis



1) Indirect position acquisition with internal encoder

Ap5135f1.fh7

Fig. 8-14: Application: Motor encoder with rotary servo axis

The following parameters

- **P-0-0074, Feedback type 1**
- **S-0-0116, Feedback 1 Resolution**
- **S-0-0277, Position feedback 1 type**

are used to parameterize the motor feedback. These specify the interface number to which the measurement system is connected, the motor feedback resolution, as well as the direction of movement, etc. The parameter **S-0-0051, Position feedback 1 value** displays the position of the motor feedback.

The absolute Measurement relative to the machine zero point is set with

- **S-0-0148, C600 Drive controlled homing procedure command**

or, for absolute encoders,

- **P-0-0012, C300 Command 'Set absolute Measurement'**

Determining the Feedback Interface of the Motor Feedback

Determining the encoder interface of the motor encoder is done with the parameter **P-0-0074, Feedback type 1**. The number of the motor encoder type must be entered. The motor encoder interface in P-0-0074 is automatically set in some motor types.

(See also chapter: "Characteristics of the Different Motor Types".)

The following measurement systems and modules may be used with motors with motor encoder interfaces that can be parameterized.

Measuring system:	Encoder interface	Value in P-0-0074	For synchronous motors	For asynchronous motors
not available (only with rotary asynchronous motors)	-	0	no	yes
digital servo feedback (LSF,HSF) or resolver	1	1	yes	yes
Incremental encoder with sine signals from (1V signals)	2	2	no	yes
Incremental encoder with square wave signals from Heidenhain	2	5	no	yes
encoder with EnDat interface from Heidenhain	2	8	yes	yes
gearwheel encoder with 1Vss signals	2	9	no	yes
resolver without feedback data memory	1	10	yes	no
resolver without feedback data memory plus incremental encoder with sine signals	1 + 2	11	yes	no
Hall encoder plus square wave encoder	1 + 2	12	yes	no
ECI encoder	1	13	yes	yes
Hall encoder plus sinus encoder	1 + 2	14	yes	no

Fig. 8-15: Determining encoder interface for the motor encoder

Note: The motor encoder is only then unnecessary if you work with a loadside motor encoder. This is only possible with rotary asynchronous motors (**P-0-4014, Motor type** = 2 or 6). In this case, the external encoder is the only control encoder (see also "Optional Encoder").

Motor Encoder Resolution

The motor encoder resolution is parameterized in the parameter **S-0-0116, Feedback 1 Resolution**. Enter the graduation scale of the motor feedback. If using a measurement system with intrinsic feedback data storage, the resolution will be taken from this and does not need to be entered.

Measurement systems with feedback storage:

- DSF, HSF
- Resolver
- EnDat

Depending on whether a rotary or linear motor is used, the units and the number of decimal places are changed via **S-0-0116, Feedback 1 Resolution**.

(see also chapter: Linear-Rotational)

Other Motor Encoder Characteristics

To parameterize the other motor encoder characteristics, use **S-0-0277, Position feedback 1 type**.

The structure of this parameter is as follows:

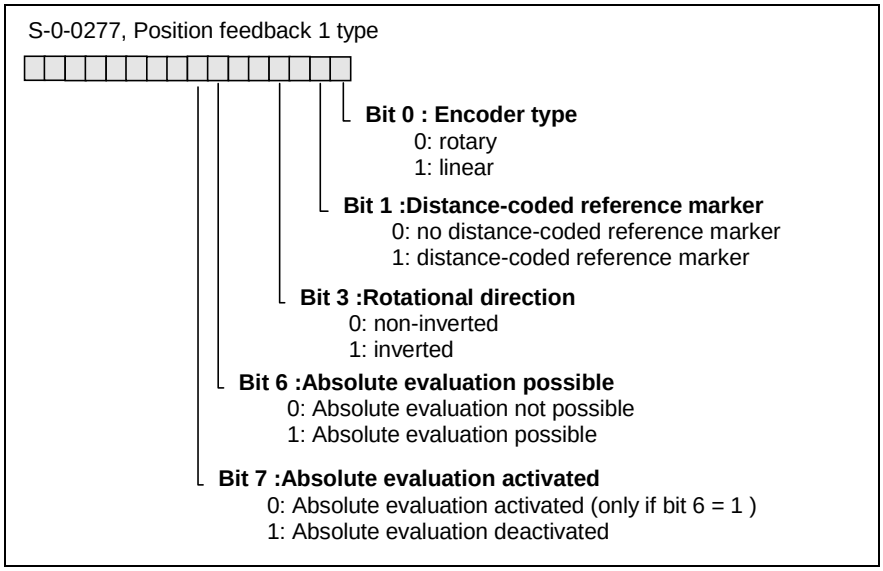

S-0-0277, Position feedback 1 type
Bit 0 : Encoder type
0: rotary
1: linear
Bit 1 :Distance-coded reference marker
0: no distance-coded reference marker
1: distance-coded reference marker
Bit 3 :Rotational direction
0: non-inverted
1: inverted
Bit 6 :Absolute evaluation possible
0: Absolute evaluation not possible
1: Absolute evaluation possible
Bit 7 :Absolute evaluation activated
0: Absolute evaluation activated (only if bit 6 = 1)
1: Absolute evaluation deactivated

Fig. 8-16: S-0-0277, Position feedback 1 type

Note: The bits in the position encoder type parameter are partially set or deleted by the drive itself.

There are following dependencies:

- If the connected motor has a motor feedback memory (MDD, MKD or MKE), then bits 0, 1 and 3 are cleared.
- If the connected motor is a linear motor, then bit 0 is set to 1.
- Depending on the absolute encoder range and the maximum travel range or modulo value, bit 6 is either set or cleared.

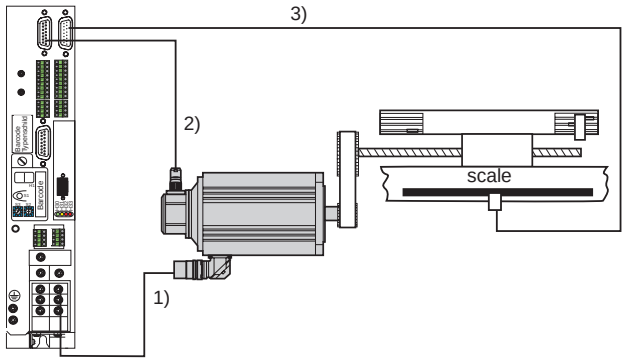
(See also chapter: "Other Settings for Absolute Measurement Systems".)

Optional encoder

A control with a direct measuring system facilitates higher contour precision of the machined workpieces in terms that it offers higher positioning accuracy. With setting the operation mode, you can determine that the position control in the drive is done with the position feedback of the optional encoder. Additionally, the velocity control can be completely or partially done with the velocity feedback signal of this measurement system.

(See also sections: "Operating Modes" and "Setting the Velocity Mix Factor".)

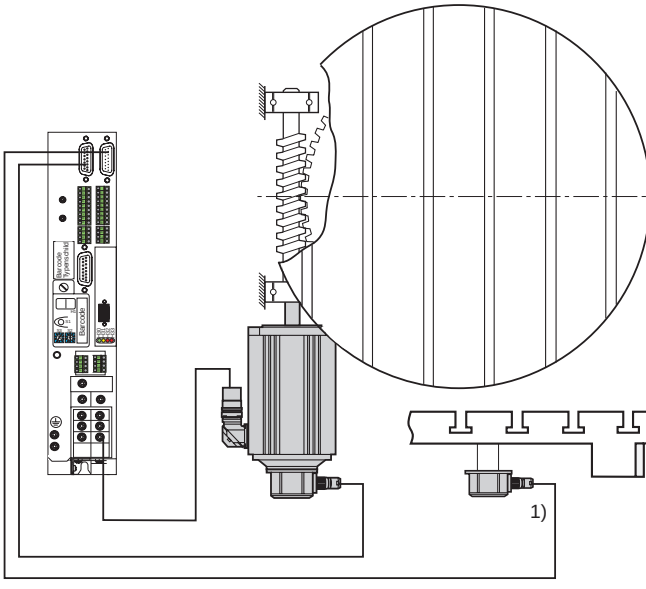
Typical application examples are shown in the following two pictures:



1) Power connectopn of motor
2) Connection of motor encoder
3) Connection of optional encoder (direct positon acquisition)

Ap5133f1.fh7

Fig. 8-17: Application: Optional encoder by linear servo axis



1) Direct position acquisition with external encoder

Ap5136 f1.fh7

Fig. 8-18: Application: Optional encoder by rotary servo axis

The optional encoder is parameterized with the

- **P-0-0075, Feedback type 2**
- **S-0-0117, Feedback 2 Resolution**
- **S-0-0115, Position feedback 2 type**
- **P-0-0185, Function of encoder 2**

parameters.

These specify:

- the feedback type which is used,
- the resolution of the optional encoder,
- the direction of movement, etc.

The parameter **S-0-0053, Position feedback 2 value** displays the position of the optional encoder.

Set the reference measure to the machine zero point as follows:

- **S-0-0148, C600 Drive controlled homing procedure command**

or, for absolute encoders

- **P-0-0012, C300 Command 'Set absolute measurement'**

The optional encoder can be used for different purposes.

The evaluation mode for the optional encoder is set in parameter **P-0-0185, Function of encoder 2**.

Value in P-0-0185, Function of encoder 2	Meaning
0	Optional encoder as an additional load-side control encoder for position and/or velocity control loops. Signal frequency monitored for exceeding maximum frequency of the interface. Upon exceeding this, error F246 Max signal frequency for encoder 2 exceeded is generated and the position status (S-0-0403) cleared.
2	Optional encoder as only load-side control encoder (only with rotary asynchronous motors). In this case, there is no other motor encoder (P-0-0074 = "0“). Parameter P-0-0121, Velocity mix factor Feedback 1 & 2 must be set to 100%.
4	Optional encoder as spindle encoder. Handled like „optional encoder as additional load-side control encoder for position and/or velocity control loops". Upon exceeding signal frequency, no error is generated but rather only the position status cleared.

Fig. 8-19: Function of the optional encoder

Determining the Encoder Interface of the Optional Encoder

Determining the encoder interface of the optional encoder uses parameter **P-0-0075, Feedback type 2**. The number of the encoder type must be entered there. The following measuring systems and modules are permitted for the evaluation of the optional encoder.

Measuring system:	Interface	Value in P-0-0075
not available	--	0
digital servo feedback	1	1
Incremental encoder with sine signals from Heidenhain with 1V signals	2	2
Incremental encoder with square wave signals from Heidenhain	2	5
encoder with EnDat interface	2	8
gearwheel encoder with 1Vss signals	2	9

Fig. 8-20: Encoder interface of the optional encoder

If "0" is entered in **P-0-0075, Feedback type 2** as encoder type, then the encoder evaluation of the optional encoder is switched off.

Optional Encoder Resolution

To parameterize the resolution of the optional encoder use the parameter **S-0-0117, Feedback 2 Resolution**.

This parameter indicates the number of lines of the optional encoder. If using a measurement system with intrinsic feedback data storage, the resolution will be taken from this and does not need to be entered.

Measurement systems with feedback storage are available if

- **DSF, HSF**
- **Encoder with EnDat-Interface**

is used as the optional encoder interface.

Depending on whether a rotary or linear measurement system was parameterized in bit 0 of **S-0-0115, Position feedback 2 type**, the unit and number of digits after the decimal is switched by **S-0-0117, Feedback 2 Resolution**.

Rotary: Cycles/Rev.

Linear: 0.00001 mm

Actual Feedback Value Monitoring

In applications where an optional measurement system is used, the position feedback monitor can offer an additional margin of safety.

The actual position monitor compares **S-0-0051, Position feedback 1 value** and **S-0-0053, Position feedback 2 value** and is thus capable of diagnosing the following axis error:

- Slip in the drive mechanical system
- Measurement system errors (as far as this is not recognized by the other measurement system monitors)

To set the monitor function use the parameter

- **S-0-0391, Monitoring window feedback 2**

If an error occurs, the error message **F236 Excessive position feedback difference** is generated.

Basic Operating Characteristics of the Position Feedback Monitor

The position feedback monitor compares the position feedback value of the encoder 1 with the encoder 2. If the deviation of both position values is greater than **S-0-0391, Monitoring window feedback 2**, the error **F236 Excessive position feedback difference** is generated. As a result, the motor and optional encoder home mark bits are cleared.

The position feedback value is only active if an optional encoder is available and evaluated and if **S-0-0391, Monitoring window feedback 2** is not parameterized with a 0.

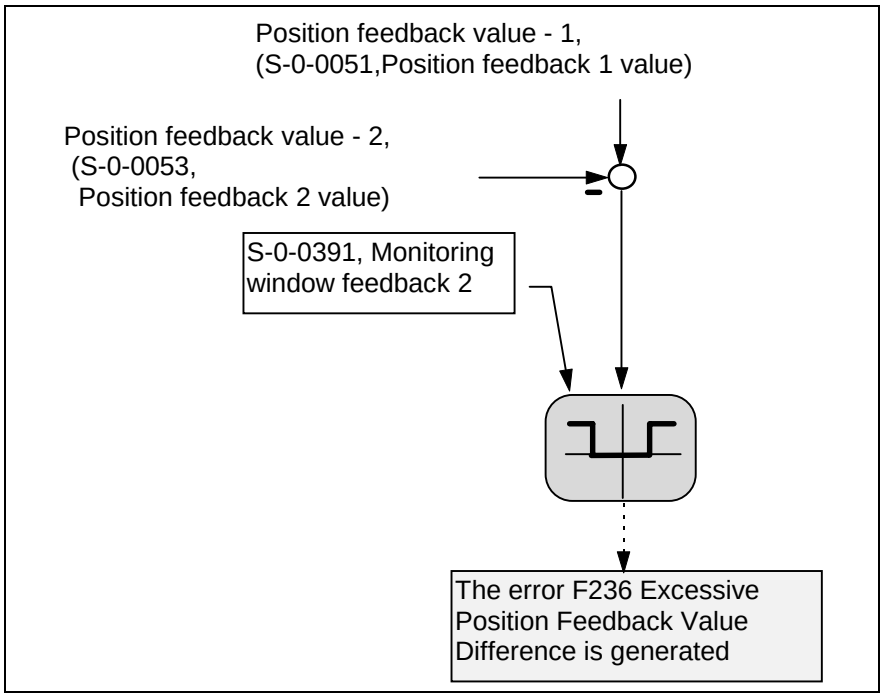

Position feedback value - 1,
(S-0-0051,Position feedback 1 value)
Position feedback value - 2,
(S-0-0053,
Position feedback 2 value)
S-0-0391, Monitoring window feedback 2
The error F236 Excessive Position Feedback Value Difference is generated

Fig. 8-21: Position feedback value monitoring schematic

Setting the Position Feedback Monitoring Window

The requirements for setting the position feedback value monitor are:

- All drive regulator loops must be set correctly.
- The axis mechanical system must be in its final form.
- The axis must be homed.

The monitoring window must be determined according to the application. The following basic procedure is recommended for doing this:

- Run a typical operating cycle. While doing this, set the planned acceleration and velocity data of the axis.
- Enter progressively smaller values in the parameter **S-0-0391, Monitoring window feedback 2** until the drive gives the error message **F236 Excessive position feedback difference**. Depending on the mechanical system, you should start with 1..2 mm and decrease the window in steps of 0.3 ... 0.5 mm.
- The value at which the monitor is triggered should be multiplied with a tolerance factor of 2 ... 3 and entered in parameter **S-0-0391, Monitoring window feedback 2**.

When determining the monitoring window, make sure that the position feedback monitor works dynamically. This means that even dynamic deviations of both position feedback values in acceleration and braking phases are registered. This is why it is not enough to use statical axis errors as the basis for the setting.

Deactivating the Position Feedback Monitor

It is possible to turn off the position feedback monitor in applications where the optionally connected measurement system does not control the axis position but is used for other measurements. To do this, enter 0 in the parameter **S-0-0391, Monitoring window feedback 2**.

Other Optional Encoder Characteristics

To parameterize any other characteristics of the optional encoder, use **S-0-0115, Position feedback 2 type**

The structure of this parameter is as follows:

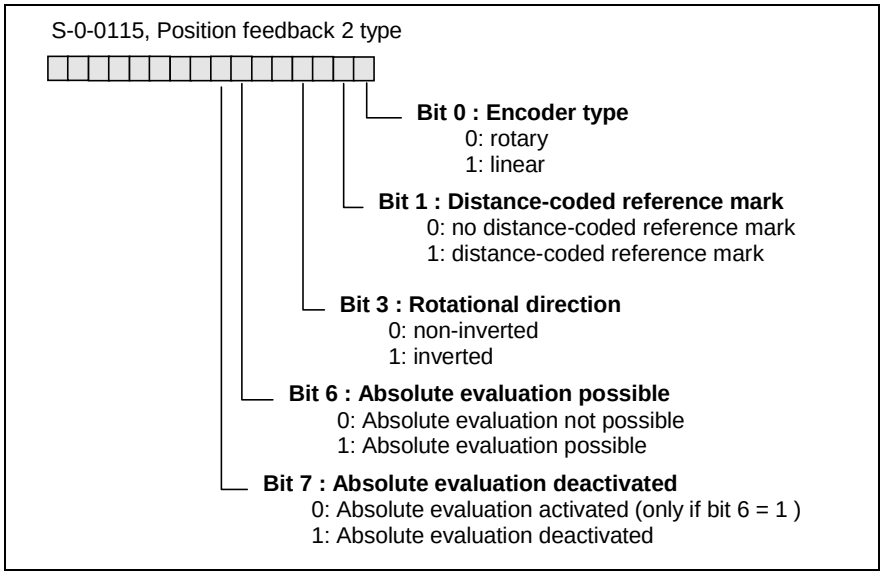

S-0-0115, Position feedback 2 type
Bit 0 : Encoder type
0: rotary
1: linear
Bit 1 : Distance-coded reference mark
0: no distance-coded reference mark
1: distance-coded reference mark
Bit 3 : Rotational direction
0: non-inverted
1: inverted
Bit 6 : Absolute evaluation possible
0: Absolute evaluation not possible
1: Absolute evaluation possible
Bit 7 : Absolute evaluation deactivated
0: Absolute evaluation activated (only if bit 6 = 1)
1: Absolute evaluation deactivated

Fig. 8-22: Parameter S-0-0115

Note: The bits in the position encoder type parameter are partly set or cleared by the drive itself. There is following dependency:

Depending on the absolute encoder range and the maximum travel range or modulo value, bit 6 is either set or cleared.

(See also chapter: "Other Settings for Absolute Measurement Systems".)

Actual Feedback Values of Non-Absolute Measurement Systems After Initialization

If there is no absolute measuring system then the initialization value can be changed via parameter **P-0-0019, Position start value**.

It hereby applies:

If the parameter is write accessed in either phase 2 or 3 then this value is assumed as the initialization value:

P-0-0019 written:	Position feedback value 1	Position feedback value 2
no	init. motor encoder raw value	init. motor encoder raw value
yes	position start value	position start value

Fig. 8-23: Non-absolute measurement system position feedback values after initialization



Warning

No valid position feedback values exist before the measurement system is initialized.
Initialization is performed during the transition check for communication phase 4.

Some measurement systems have limitations concerning the maximum velocity during their initialization.

Measurement system	Maximum initialization velocity
DSF/HSF	300 rpm
EnDat	Initialization should occur at standstill
Multiturn resolver	300 rpm

Fig. 8-24: Velocity allowed during initialization

Drive-internal format of position data

There are two different formats in the drive used to display position data. We differentiate between

- **display format** and
- **drive-internal format**.

The **display format** defines the unit, i.e., the value with which the position data are exchanged between drive and control/surface. When a position data parameter is read, it is sent in the display format to the control. The display format is set with parameter **S-0-0076, Position Data Scaling Type**, **S-0-0077, Linear Position Data Scaling Factor**, **S-0-0078, Linear Position Data Scaling Exponent** and **S-0-0079, Rotational position resolution**. The control generally sets the format.

(See also "Physical Values Display Format“.)

The drive-internal positon resolution depends on the travel range to be described

The **drive-internal format** determines the value, the position command and feedback value editing as well as how the position control loop in the drive is performed. The drive uses the value of parameter **S-0-0278, Maximum travel range** to calculate the drive-internal format.

Note: If the value set in **S-0-0278, Maximum travel range** is used as set at delivery, then the drive-internal format generally meets most demands given a sufficiently high resolution. Only if excessively high demands are made of the drive-internal format of the position data or with very long travel ranges it becomes necessary to optimize the setting.

Functional principle of the drive-internal position data formats

Position data processing in the drive has a constant data width from which the resolution of the position data to cover the travel range of the axis depends.

It applies:

Note: The longer the distance to be represented, the smaller the drive-internal position resolution.

These parameter values are used to compute the **drive-internal resolution**:

- **S-0-0116, Feedback 1 Resolution** and
- **S-0-0256, Multiplication 1**.

The parameters for the encoder resolution are listed in the data sheets of the measuring system or they are automatically read out of the feedback memory if such a measuring system is present. The number of lines per encoder revolution or the grid constant of a linear scale (distance per division period) is set there. The parameter values for the multiplication are calculated by the drive during command **S-0-0128, C200 Communication phase 4 transition check**. They describe the resolution per division period (dp).

It thus applies for the drive-internal resolution:

for rotary motors:

$$\text{Resolution} = \text{encoderresolution} \times \text{multiplication}$$

Resolution:	drive-internal resolution of position data [Incr/rev]
multiplication:	value in S-0-0256 or S-0-0257 [Incr/dp]
encoder resolution:	value in S-0-0116 or S-0-0117 [dp/Incr]

Fig. 8-25: Drive-internal resolution of rotary motors

and for linear motors:

$$\text{Resolution} = \frac{\text{multiplication}}{\text{encoderresolution}}$$

Resolution:	drive-internal resolution of positon data [Incr/mm]
multiplication:	value in S-0-0256 or S-0-0257 [Incr/dp]
encoder resolution:	value in S-0-0116 or S-0-0117 [dp/mm]

Fig. 8-26: Drive-internal resolution of linear motors

Examples:

1. MKD motor, S-0-0116 = 4, S-0-0256 = 32768, therefore: drive-internal resolution = 131072 increments/motor revolution or 0.00275 degrees/increment.
2. Linear scale as optional measuring system, S-0-0117 = 0.02 mm (grid division = 20µm), S-0-0257 = 32768, therefore: drive-internal resolution of approximately 1638400 increments/mm or 0.00061 µm (How to compute the drive-internal resolution if an optional encoder is used, is described in greater detail below).

Note: The value for the multiplication is limited to
4 .. 4194304
for technical reasons.

Setting the drive-internal position data format

To set the drive-internal resolution, use the parameter **S-0-0278, Maximum travel range**.

Setting the maximum travel range at start-up

This parameter must be set at the time where an axis is commissioned to a value that equals at least the distance that the axis must travel. While executing the command **S-0-0128, C200 Communication phase 4 transition check,** the drive computes the values for **S-0-0256, Multiplication 1** and, if an optional measuring system is mounted, for **S-0-0257, Multiplication 2** as well. These parameters thus help to display the resolution.

Multiplication is only reduced if the travel range can no longer be described

The maximum possible resolution of the position feedback value of a position encoder for technical reasons equals 32768 increments per division period of the measuring system. This maximum resolution is only reduced if the travel range is set so large that it can no longer be described with the maximum resolution.

To compute the **multiplication**, the following calculations are conducted in the command **S-0-0128, C200 Communication phase 4 transition check**:

for **rotary** measuring systems:

$$\text{multiplication} = \frac{2^{31}}{\text{travel range} \times \text{encoder resolution}}$$

travel range:	travel range shown in encoder revolutions
multiplication:	value in S-0-0256 or S-0-0257
encoder resolution:	value in S-0-0116 or S-0-0117

Fig. 8-27: Relationship between maximum travel range and multiplication with rotary measuring systems

Examples:

1. MHD motor with S-0-0116 = 512, maximum travel range 2048 motor revolutions, therefore, a multiplication of 2^31 / (2048 • 512) = 2048.
2. MHD motor with S-0-0116 = 512, maximum travel range 20 motor revolutions, therefore, a multiplication of 2^31 / (20 • 512) = 209715. The next higher value equals 32768, thus a multiplication = 32768.

for <u>linear</u> scales:

$$\text{multiplication} = \frac{2^{31} \times \text{encoder resolution}}{\text{travel range}}$$

travel range:	travel range shown in mm
multiplication:	value in S-0-0256 or S-0-0257
encoder resolution:	value in S-0-0116 or S-0-0117

Fig. 8-28: Relationship between maximum travel range and multiplication in linear scales

Example:

1.) Linear scale with 0.02mm grid division, maximum travel range 5m, therefore a multiplication of 2^31 × 0.02 / 5000 = 8589 (→ 8192).

This results in a resolution of 0.02mm / 8192 = 0.002441 µm.

Note: When computing multiplication always use the next lower binary value of the precise results.

Drive internal representation of position data when an optional encoder is present

If an optional encoder is mounted, the multiplication of the motor encoder is guided by the optional encoder

If there is an optional measuring system, then the multiplication of this encoder is computed as per the above formula in terms of the travel range set. The multiplication of the motor encoder is calculated so that it also covers this travel range. This means that values exceeding 32768 can be generated depending on the mechanical transformation elements!

Example: MKD motor with rotary optional encoder

motor encoder resolution	= 4
optional encoder resolution	= 1000
travel range	= 50 revolutions
gear ratio	= 1:1

1. Calculating the multiplication of the optional encoder:

2^31 / (1000 • 50) = 42949, technical maximum 32768, thus S-0-0257 = 32768.

This results in a resolution of 0.00001098 Degrees.

2. Calculating the multiplication of the motor encoder

2^31 / (4 • 50) = 10737418, the next smaller binary value = 8388608, thus S-0-0256 = 8388608. However, the technical maximum resolution is 4194304. Therefore, we set the value in S-0-0256 to 4194304. The resolution is 0.0002146 Degrees.

The resolution can never exceed 4194304 • S-0-0116!

Example: MHD motor with linear optional encoder

Resolution of the motor encoder	= 256
Resolution of the optional encoder	= 0.02 mm
Travel range	= 5 m
feed constant	= 10 mm
Gear transmission ratio	= 3:1

1. Calculating the multiplication of the optional encoder :

2^31 • 0.02mm / 5000mm = 8589

Technically reasonable is a maximum of 8192, therefore

S-0-0257 = 8192. This gives a resolution of 0.00244 µm.

2. Calculation of the Multiplication of the motor encoder:

5m of travel range give 500 gear output revolutions and therefore 1500 gear input revolutions (motor revolutions).

2^31 / (256 • 1500) = 5592, the nearest smaller binary value = 4096, therefore S-0-0256 = 4096.

This results in a resolution of 0.000343 Degrees referred to the motor shaft.

Processing format of the drive-internal position command interpolator

In the drive-internal position command interpolator, the position command profile for the drive-controlled travel commands such as drive halt, drive-controlled homing, operating mode drive-internal interpolation and so on are generated. The format of the drive-internal position data affect the maximum acceleration limit which can be pre-defined for the interpolator.

The limits are not valid for cyclic command values, e.g. in operation mode Position control.

The following relationships apply:

for **rotary** motors:

$$amax = \frac{51.471.854.040}{\text{encoder resolution} \times \text{multiplication}} \left[\frac{rad}{s^2}\right]$$

amax: maximum acceleration of position command of the interpolator
encoder resolution: value in S-0-0116
multiplication: value in S-0-0256

Fig. 8-29: Maximum acceleration of the position command interpolator as dependent on the drive-internal position data format

for **linear** motors:

$$amax = \frac{8.192.000.000 \times \text{encoder resolution}}{\text{multiplication}} \left[\frac{mm}{s^2}\right]$$

amax: maximum acceleration of position command of the interpolator
encoder resolution: value in S-0-0116 in mm
multiplication: value in S-0-0256

Fig. 8-30: Maximum acceleration of the position command interpolator as dependent on the drive-internal position data format

Example:

MHD motor with S-0-0116 = 512, multiplication = 32768, equalling a maximum acceleration of the position command interpolation of 3067 rad/s².

8.3 Other Settings for Absolute Measurement Systems

Encoder Types and Pertinent Interfaces

The following table outlines which absolute measuring system can be used as motor encoder or as an optional encoder. Listed aso is the encoder interface that is recommended.

Measuring system:	Interface (input no.):	as motor encoder	as optional encoder
Single/multiturn DSF/HSF	Standard(1)	yes	yes
Single/Multiturn LSF	Standard(1)	yes	yes
Single/multiturn resolver	Standard(1)	yes	no
Linear scales from Heidenhain with EnDat interface	Optional(8)	yes	yes
Single/multiturn rotary encoder from Heidenhain with EnDat interface	Optional(8)	yes	yes
ECI-Single/Multi	Standard(1)	yes	no

Fig. 8-31: Absolute measuring system and their interfacesn

Motor and/or optional encoders can be used as absolute encoders

As motor and/or optional measuring system those measuring systems can be used that supply absolute position information within one or several revolutions (single or multiturn encoder) or a within a specific traversing distance (absolute linear scales).

The information about which range (absolute encoder range) a measuring system can supply absolute position information about is stored in the ata memory of the measuring system or the drive software. Absolute measuring systems do not have to be homed after initialization of the drive firmware. The actual position value lies within the absolute encoder range, machine zero related, after initialization. It is only necessasry to conduct a single setup procedure (setting absolute dimension).

Whether a motor or an optional measuring system are to be evaluated as encoders, depends on the following variables:

- the absolute encoder range (**S-0-0378, Absolute encoder 1, range / S-0-0379, Absolute encoder 2, range)** of the relevant encoder.
- the set position scaling (position data represented absolute or in modulo formats) in **S-0-0076, Position data scaling type**
- the travel range set in **S-0-0278, Maximum travel range** or
- the modulo value set in parameter **S-0-0103, Moduleo value.**

Note the following relationships:

Position scaling (Bit 6 of S-0-0076)	**S-0-0278, Max. travel range**	**S-0-0103, Moduleo value**	**Absolute encoder evaluation possible**
Absolute format	<= ½ * S-0-0378 or ½ * S-0-0379	not relevant	yes
	> ½ * S-0-0378 or ½ * S-0-0379	not relevant	no
Modulo format	>=S-0-0103	<= S-0-0378 or S-0-0379	yes
	>=S-0-0103	> S-0-0378 or S-0-0379	no

Fig. 8-32: Absolute encoder evaluation as depends on position format, modulo format and maximum travel range

The check whether a measuring system can be evaluated as an absolute system is conducted during command **S-0-0128, C200 Communication phase 4 transition check**. The results are displayed in bit 6 of the relevant position encoder type parameter (S-0-0277 / S-0-0115).

Activating the absolute encoder evaluation

If the absolute evaluation of a measuring system is possible but not wanted, this can be deselected in bit 7 of the position encoder type parameter. The measuring system is then treated as if it were a non-absolute (single turn) encoder.

The position encoder type parameter is structured as follows:

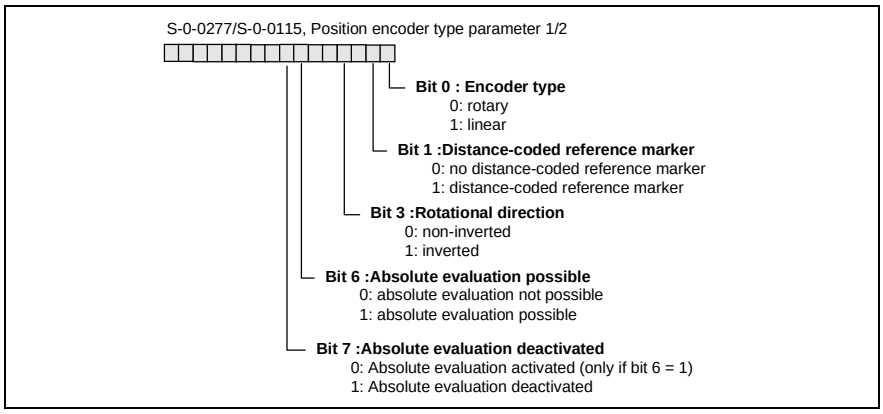

S-0-0277/S-0-0115, Position encoder type parameter 1/2
Bit 0 : Encoder type
0: rotary
1: linear
Bit 1 :Distance-coded reference marker
0: no distance-coded reference marker
1: distance-coded reference marker
Bit 3 :Rotational direction
0: non-inverted
1: inverted
Bit 6 :Absolute evaluation possible
0: absolute evaluation not possible
1: absolute evaluation possible
Bit 7 :Absolute evaluation deactivated
0: Absolute evaluation activated (only if bit 6 = 1)
1: Absolute evaluation deactivated

Fig. 8-33: Structure of the position encoder type parameter

Pre-requisites for correctly generating absolute position information:

The correct generation of the machine zero-point related actual position value is only possible if the relevant conditions have not changed. The conditions for the correct conversion of the measurement system related position information in the machine zero point related actual position value are made up of:

Monitoring absolute encoder evaluation conditions

- the rotational direction of the measuring system set in parameters **S-0-0277, Position feedback 1 type** or **S-0-0115, Position feedback 2 type** in bit 3
- the position polarity set in **S-0-0055, Position polarities**
- the multiplication determined based on **S-0-0278, Maximum travel range** displayed in parameters **S-0-0256, Multiplication 1** or **S-0-0257, Multiplication 2**.

are changed

If one of these three conditions changes, then the position status of the relevant measuring system is cleared (**S-0-0403, Position feedback value status** = "0“) and the error **F276 Absolute encoder out of allowed window** is generated.

Absolute Encoder Monitoring

If the absolute evaluation of a measuring system has been activated (position encoder type parameter S-0-0277 or S-0-0115 = 01xx.xxxxb), then in command **S-0-0128, C200 Communication phase 4 transition check** the actual position value is generated and monitored. The monitoring of the actual position value is only active if the encoder is in reference.

Functional principle of the absolute encoder monitor

When turning off the drive's power supply, the current actual position of the axis is loaded into resident memory. When switching the axis back on, the difference of the stored position and the newly initialized position of the measuring system is built. If this difference is greater than the parameterized position window in parameter **P-0-0097, Absolute encoder monitoring window**, the error message **F276 Absolute encoder out of allowed window** is given.

The absolute encoder monitor is appropriate for the following applications:

- The motor is equipped with a holding brake.
- The drive mechanical system is self-locking and cannot be moved manually.

Setting the Absolute Encoder Monitor

The absolute encoder monitoring window must be set by the user. Always select greater than the maximum allowable motion of the axis

when shutdown. Assuming that the axis has a brake or is self-locking, you can enter 0.1 motor revolutions (36° in reference to the motor shaft) as a standard value for the parameter **P-0-0097, Absolute encoder monitoring window**.

Absolute encoder monitoring with two absolute encoders

If there are absolute measuring systems and the absolute encoder monitor of the position data is activated, then the following restriction applies:

If both motor and optional encoder are evaluated absolutely, then only that one is monitored as an absolute encoder that has been set in bit 3 of parameter **S-0-0147, Homing parameter**.

See also chapter: absolute encoder monitoring.

Deactivating the Absolute Encoder Monitor

The absolute encoder monitor cannot be effectively used with axis that can or must be moved manually when switched off. The absolute encoder monitor should be turned off in such situations in order to prevent unnecessary error conditions.

The absolute encoder monitor can be turned off by writing 0 to **P-0-0097, Absolute encoder monitoring window.**

Moduleo Analysis with two absolute encoders

If measuring systems are evaluated absolutely and modulo evaluation of the position data is activated, then the following restrictions apply:

If both motor encoder and optional encoder are to be evaluated absolutely, then only that one is evaluated as an absolute encoder, which is set in bit 3 of parameter **S-0-0147, Homing parameter**.

(See also chapter: "Modulo Feature").

Actual Feedback Values of Absolute Measurement Systems After Initialization

The condition of the position feedback values of the motor feedback and, if available, of the optional feedback after initializing in the command **S-0-0128, C200 Communication phase 4 transition check** depends on:

- Bit 3 in **S-0-0147, Homing parameter**
- Availability of an absolute feedback as the motor or optional feedback.

Motor feedback:	Optional feedback:	S-0-0147 Bit 3:	S-0-0051, Position feedback value 1:	S-0-0053, Position feedback value 2:	S-0-0403, Pos. status:
absolute	not absolute	0	absolute value of motor feedback	absolute value of motor feedback	1
absolute	not absolute	1	absolute value of motor feedback	absolute value of motor feedback	0
not absolute	absolute	0	absolute value of optional feedback	absolute value of optional feedback	0
not absolute	absolute	1	absolute value of optional feedback	absolute value of optional feedback	1
absolute	absolute	arbitrary	absolute value of motor feedback	absolute value of optional feedback	1

Fig. 8-34: Position feedback values of absolute measurement systems after initialization

Note: Absolute position is lost with changes in polarity, scaling, gearbox and so on.

8.4 Drive Limitations

Current Limit

Controllers, motors and machines are subject to various limits to protect them against damage from overload. This protection is based on a **dynamic drop of the current** computed for the output stage of the controller and the motor, in addition to parameters set by the user for another purpose.

The maximum current that may flow for a short period of time or that is available as continuous current is specified in the relevant parameters

- **P-0-4046, Active peak current** and
- **P-0-4045, Active permanent current**.

Pertinent Parameters

- **S-0-0110, Amplifier peak current**
- **P-0-4004, Magnetizing current**
- **S-0-0109, Motor peak current**
- **S-0-0111, Motor current at standstill**
- **S-0-0092, Bipolar torque/force limit value**
- **P-0-0109, Torque/force peak limit**
- **P-0-4011, Switching frequency**

Functional Principle

P-0-4046, Active peak current

Using parameters **S-0-0092, Bipolar torque/force limit value** and **P-0-0109, Torque/force peak limit** the user limits current and torque to a fixed maximum value whereby **torque at standstill** or **the force of the motor at standstill** serve as the **reference**.

The maximum possible currents for the machine are fixed by the peak current of the machine and the peak current of the motor. These values may not be exceeded. And, as these are the total flowing currents, the magnetization current is deducted from these values for display in parameter **P-0-4046, Active peak current**.

Motor current limitation

The current is dynamically reduced to **2.2-times of the standstill current** of the motor **to protect the motor against overheating**. (Motor current limitation).

Thermal current limit of the controller

To protect the controller from overheating, the current is dynamically reduced to **P-0-4045, Active permanent current**. (Thermal current limit of the controller).

Note: At high speeds, the maximum possible motor current is also reduced by the pullout current limit.

The smallest value derived from all these limitations is displayed in parameter **P-0-4046, Active peak current**. The controller can supply this maximum current momentarily.

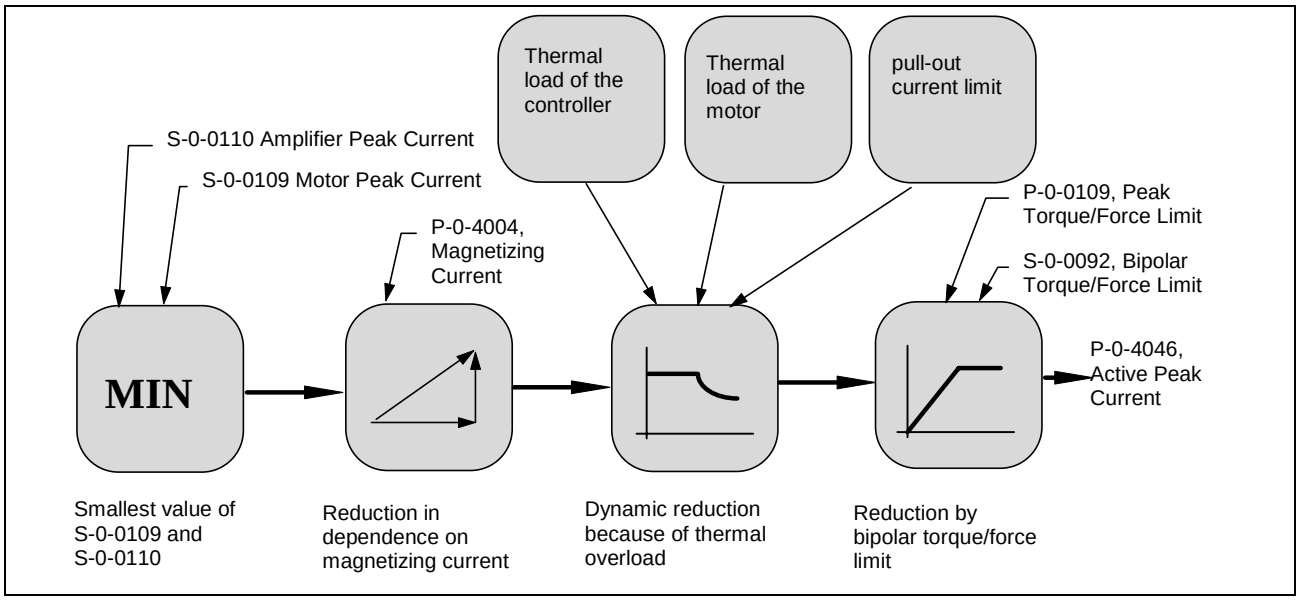

Thermal load of the controller
Thermal load of the motor
pull-out current limit
S-0-0110 Amplifier Peak Current
S-0-0109 Motor Peak Current
P-0-4004, Magnetizing Current
P-0-0109, Peak Torque/Force Limit
S-0-0092, Bipolar Torque/Force Limit
MIN
P-0-4046, Active Peak Current
Smallest value of S-0-0109 and S-0-0110
Reduction in dependence on magnetizing current
Dynamic reduction because of thermal overload
Reduction by bipolar torque/force limit

Fig. 8-35: Value displayed in P-0-4046, actual peak current

P-0-4045, Active permanent current

That current displayed in parameter **P-0-4045, Active permanent current** is the continuous current value availabel from the drive. This current depends largely upon

- the machine type and
- the switching frequency of the output stage.

This **unit-specific** value is additionally reduced by the magnetization current as parameter **P-0-4045, Active permanent current** only displayed the torque-generating portion of the motor current.

Note: If the effective peak current is smaller than the effective continuous current, then the effective continuous current is set to the value of the effective peak current. This can be the case if the peak motor current is smaller than the continuous current of the controller or the current limit of the motor reduces the current to under the continuous current of the controller.

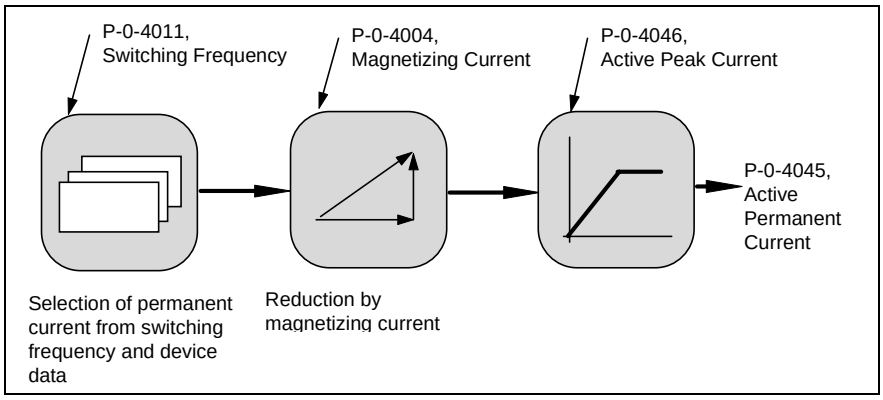

P-0-4011, Switching Frequency
P-0-4004, Magnetizing Current
P-0-4046, Active Peak Current
P-0-4045, Active Permanent Current
Selection of permanent current from switching frequency and device data
Reduction by magnetizing current

Fig. 8-36: Parameter value of the effective continuous current

Thermal current limit of the controller

It is the task of the thermal current limit of the controller to **protect the unit against overheating**. To do so, the thermal controller load **(P-0-0141**) is computed from

- the controller-specific data,
- the command current profile and
- the selected switching frequency.

If this reaches 100%, then the peak current is reduced.

The maximum current that can be continuously supplied by the controller, is displayed in parameter **P-0-4045, Active permanent current**. This current also leads to a 100% load. To what extent and how quickly the current can be reduced depends on how the actual current supplied by exceeds the effective continuous current.

Should the current being supplied once again drop to under the effective continuous current, then the load of the unit sinks and the maximum possible current increases.

To monitor the thermal controller load, two warnings are issued:

- **E257 Continuous current limit active** is issued when the load reaches 100%.
- **E261 Continuous current limit prewarning** is issued when the load reaches the value set in parameter **P-0-0127, Overload warning**.

This means that a response to any eventual overload is possible even before a peak torque reduction. It makes sense to parametrize a value of **80%** for this purpose. This value should not be exceeded when operating the drive under normal conditions.

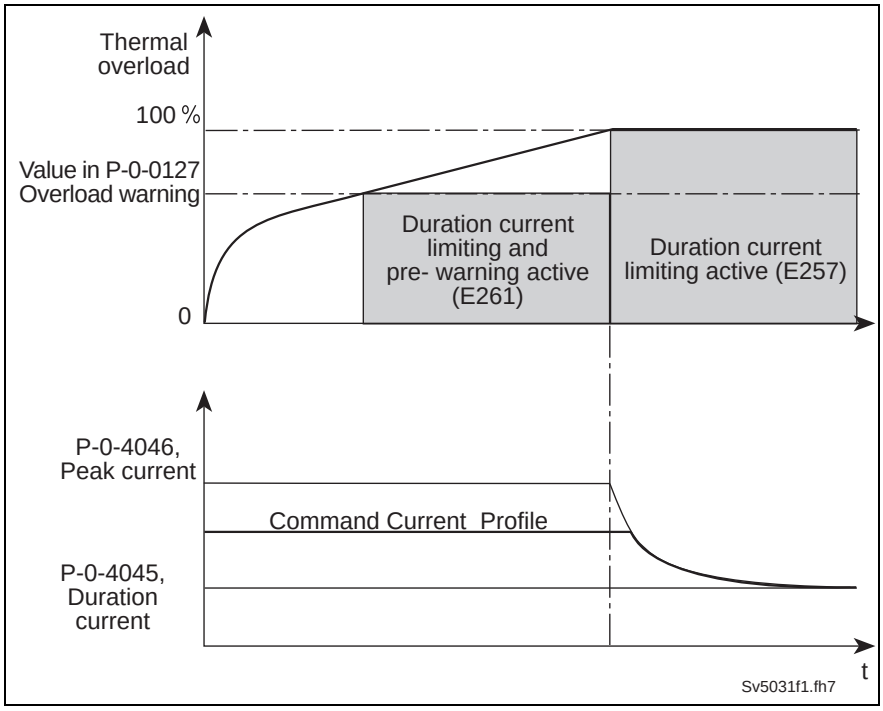


Fig. 8-37: Monitoring the thermal load and continous current limit

Checking the thermal load of the drive controller

Parameter **P-0-0141, Thermal drive load** can be used to check the extent of the controller load. A correct layout would mean that this would never exceed **80%**.

To check the load it is possible to subject the machine to a test run. The time until the load achieves a **stationary condition** must be greater than **10 minutes**.

To check the thermal load of a drive at the time of a startup without having to run a machining process, it is possible to pre-set the controller load to 80%. To do so, write any value into parameter **P-0-0141, Thermal drive load**. It is necessary to briefly and simultaneously run a **typical processing cycle,** however. The thermal load should be observed and it must demonstrate a **falling tendency** as otherwise the drive has been incorrectly sized for the application.

To check the further increase of the thermal load beyond 80% use

- the overload warning **P-0-0127, Overload warning** and/ or
- the **P-0-0141, Thermal drive load** output

using the analog output.

A typical curve of the thermal load as can be observed with analog output, is displayed below.

Note: **By presetting** P-0-0141, **Thermal drive load** to 80%, the processing cycle is set to this load.

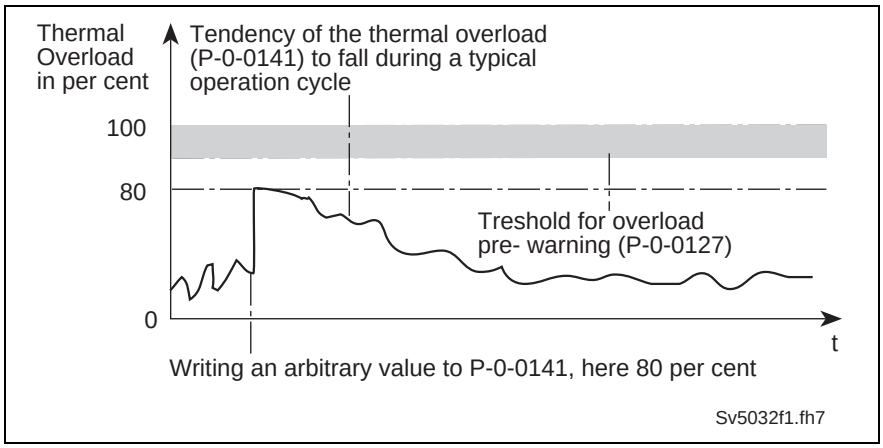


Fig. 8-38: Checking the thermal load

Motor current limit

The motor may be loaded for a maximum of **400 msec** with the **4-fold** value of **S-0-0111, Motor current at standstill**. During continuous operation, a **2.2-fold** value is permitted. If the maximum value is exceeded for an extended period, however, then the motor current limit reduces the maximum motor current to 2.2-times the motor standstill current.

For the maximum motor current to increase again, it is necessary to first reduce the load on the motor, i.e., the current must drop below the 2.2-fold motor standstill current.

If the motor overload limit is active then

- warning **E225 Motor overload** is generated and
- **Bit 0** (overload warning) in **S-0-0012**, **Class 2 diagnostics** is set.

Pull-out current limit

For physical reasons it is necessary to limit the maximum actual current of the motor to a specific speed. The pull-out current limit is used for this purpose. This limit is limited purely by the **technical structure** of the motor and cannot be influenced. Paramter **P-0-0532, Premagnetization factor** is used to set this in asynchronous motors. (See section: "Asynchronous Motors".)

Torque Limit

Parameters

- **S-0-0092, Bipolar torque/force limit value**
- **P-0-0109, Torque/force peak limit**

specify the per cent value of **S-0-0111, Motor current at standstill** that can be maximumly made available.

Variable torque limit

Parameter **S-0-0092, Bipolar torque/force limit value** is used to specify variable limits of the maximum drive torque to values smaller than the maximum possible one. This makes sense, for example, given a successive and quick approaches to an end limit.

Peak torque limit

Due to the maximum allowable current of any motor/controller combination, there is a specific peak torque which is desirable with many applications for acceleration processes. There are, however, cases where the maximum peak torques must be limited to lower values for application reasons. Parameter **P-0-0109, Torque/force peak limit** can be used to limit the maximum peak torque of a drive for an application. This parameter ensures that the allowable maximum peak torque for an application then not exceeded even if **S-0-0092, Bipolar torque/force limit value** is set to a high value.

The following illustrates the interplay of current limit and torque limit for determining the maximum output current.

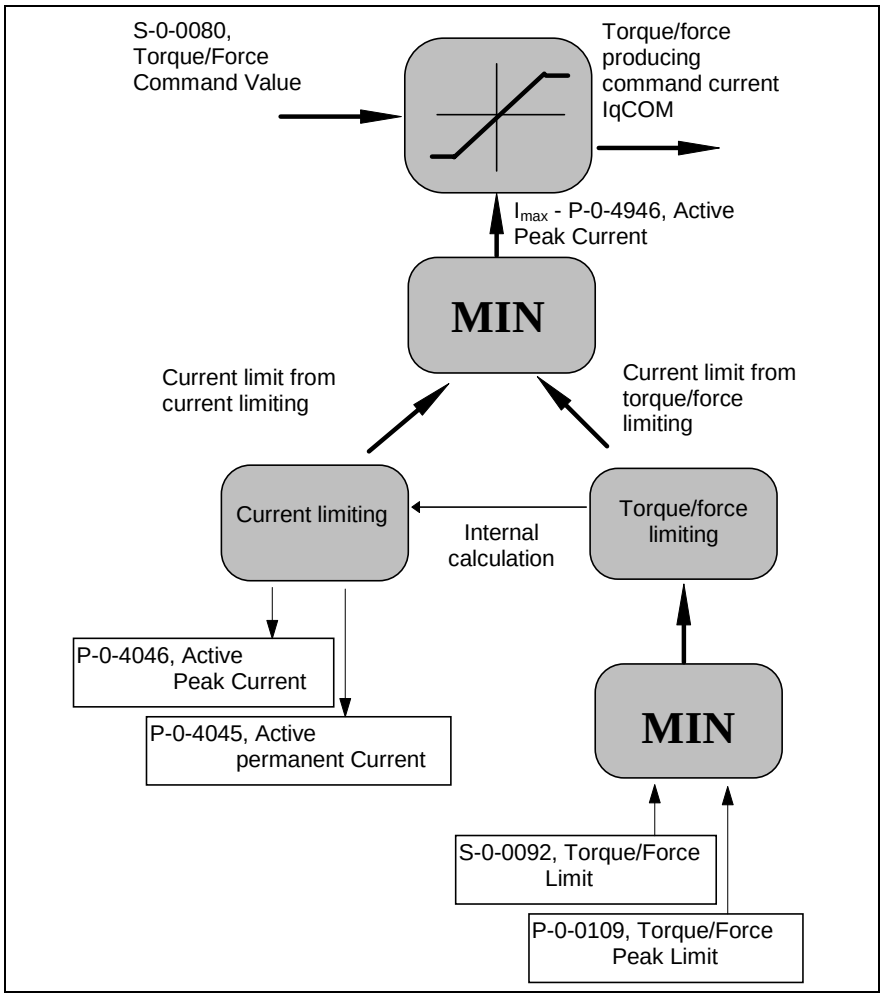


Fig. 8-39: Current limitation and torque/force limitation

The current and torque limits both effect the limit of the torque-generating command current displayed in parameter **P-0-4046, Active peak current**.

Note: The smaller of the two limit values is effective in this case!

Limiting Velocity

The following parameters limit the velocity of the drive:

- **S-0-0113, Maximum Motor Speed (nmax)**
- **S-0-0091, Bipolar Velocity Limit Value**

The parameter **S-0-0091, Bipolar Velocity Limit Value** is designed to allow variable limits of the maximum velocity to values smaller than the maximum allowable velocity during operation.

The parameter **S-0-0113, Maximum Motor Speed (nmax)** designates the maximum possible motor velocity. It is contained in the motor encoder data storage of MHD-, MKD and MKE motors and does not need to be entered, but with other types of motors this value must be taken from the motor parameter specifications.

Limiting to Maximum Motor Velocity

The maximum motor velocity defines the maximum velocity of the drive. It becomes active and is included in the calculation of

- the maximum value entered in the parameter **S-0-0091, Bipolar Velocity Limit Value**

Limiting to Bipolar Velocity Limit Value

The bipolar velocity limit value defines the maximum velocity of the drive for the user. It becomes active as

- the monitor of the encoder velocity in the **torque control** operating mode
- the limit for the resulting command value in the velocity controller
- the monitor of the position command value difference in the **position control** operating mode (see also "position command value monitoring")
- the limit of **S-0-0036, Velocity Command Value** in the **velocity control** operating mode

Monitoring the Feedback Velocity in the Torque Control Operating Mode

Monitoring the Feedback Velocity in the **Torque Control** operating mode occurs at 1.125 times the value of **S-0-0091, Bipolar Velocity Limit Value**. If this value is exceeded, the fatal error

- **F879 Velocity limit S-0-0091 exceeded**

is generated. The drive switches to torque-free operation afterwards.

Limiting the Resulting Command Value in the Velocity Controller

In all operating modes in which the velocity controller is active (all operating modes except for **Torque Control**), the given velocity command value is limited to the value of **S-0-0091, Bipolar Velocity Limit Value**. If this condition is reached, the warning

- **E259 Command Velocity Limit active**

is generated.

Limiting S-0-0036, Velocity Command Value in the Velocity Control Operating Mode

In the velocity control operating mode, the input of **S-0-0036, Velocity Command Value** is limited to **S-0-0091, Bipolar Velocity Limit Value**. If the value entered in S-0-0036 exceeds this limit, the warning

- **E263 Velocity command value > limit S-0-0091**

is generated.

Travel Range Limits

To avoid accidents and damages to the machine, many safety precautions are provided. A part of these safety measures refers to limiting the allowed working range. These limits can be introduced by following measures :

- Software limits in the control (only active with axis in reference)
- Position limits in the drive (only active with axis in reference)
- Limit switches in the drive
- Safety limit switches (in the emergency/safety chain)

Relevant Parameters

- **S-0-0049, Positive position limit value**
- **S-0-0050, Negative position limit value**
- **S-0-0055, Position polarities**
- **S-0-0403, Position feedback value status**
- **P-0-0090, Travel limit parameter**
- **P-0-0222, Status Inputs travel range limits**

Functional principle of travel range limits

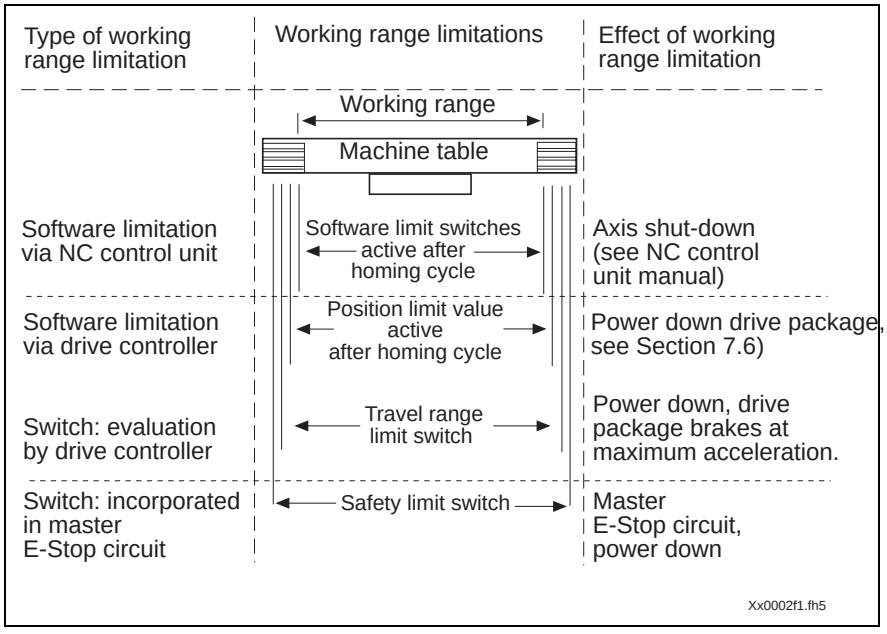

Type of working range limitation
Working range limitations
Effect of working range limitation
Working range
Machine table
Software limitation via NC control unit
Software limit switches active after homing cycle
Axis shut-down (see NC control unit manual)
Software limitation via drive controller
Position limit value active after homing cycle
Power down drive package, see Section 7.6)
Switch: evaluation by drive controller
Travel range limit switch
Power down, drive package brakes at maximum acceleration.
Switch: incorporated in master E-Stop circuit
Safety limit switch
Master E-Stop circuit, power down
Xx0002f1.fh5

Fig. 8-40: Effect and ways of limiting the working range

There are two methods in the drive itself..

These are the monitors for

- Travel zone limit switches and
- Position Limit Values for the axis

The travel range is exceeded when either a travel zone limit switch is activated or one of the two axis limit values is exceeded by the homed position feedback value that is, the value referring to the machine zero point.

The drive's response to exceeding the travel range is selectable. The following possibilities exist:

- An error with a "Set Velocity Command Value to Zero" reaction and automatic drive enable shutoff
- A warning with a "Set Velocity Command Value to Zero" reaction and automatic reset when the error conditions are gone.

This is set in bit 2 of **P-0-0090, Travel limit parameter**:

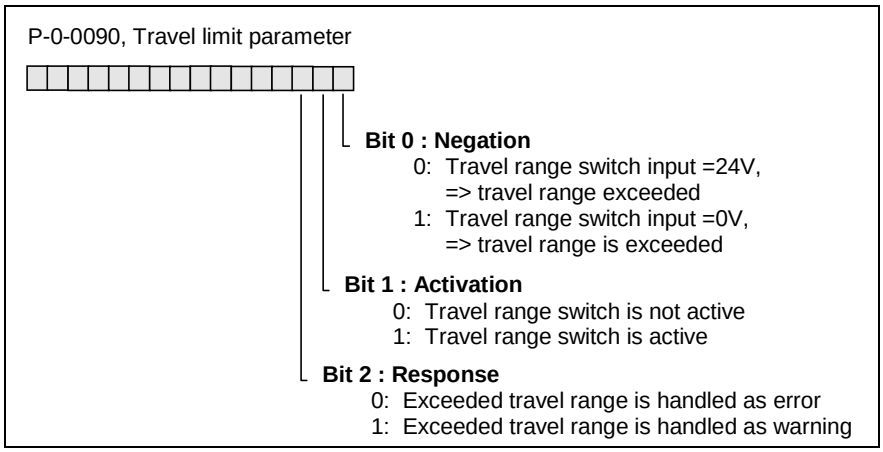

P-0-0090, Travel limit parameter
Bit 0 : Negation
0: Travel range switch input =24V,
=> travel range exceeded
1: Travel range switch input =0V,
=> travel range is exceeded
Bit 1 : Activation
0: Travel range switch is not active
1: Travel range switch is active
Bit 2 : Response
0: Exceeded travel range is handled as error
1: Exceeded travel range is handled as warning

Fig. 8-41: Setting the drive reaction to exceeding the travel range (bit 2)

Note: Decelerating the axis with the use of a velocity command value ramp is not possible! Braking always occurs at maximum allowable torque (see P-0-4046, Active peak current).

Exceeding the Travel Range as an Error

If a 0 is entered in bit 2 of P-0-0090, then exceeding the travel range is handled as an error with the reaction of the velocity command value being set to zero. (See also chapter: "Velocity Command Value Reset".)

After the velocity command value has been set to zero, the drive turns off the internal drive enable and becomes torque-free. The ready-to-operate contact opens.

For re-installation

- Clear the error with the command **S-0-0099, C500 Reset class 1 diagnostic** or press the S1 button.
- Reactivate the drive with the 0-1 edge of the drive enable signal.
- Restart the state machine of the DriveCom profile.

If the error condition is still present, that is, if the limit switch is still activated or if the axis limits are still exceeded, only command values that go back into the allowable range will be accepted. Monitoring the command values is dependent on the active operating mode.

The following applies:

Operating Mode:	Command Value Check:
Torque control	Polarity of **S-0-0080, Torque/Force command**
All operating modes with drive-internal velocity control	Polarity of the internal velocity command value
All operating modes with drive-internal position control	Polarity of the velocity created by the given position command values

Fig. 8-42: Monitoring the command values in error conditions

If command values are given that would lead out of the allowable travel range, the travel range error will be generated again.

Exceeding the Travel Range as a Warning

If a 1 is entered in bit 2 of **P-0-0090, Travel limit parameter,** then exceeding the travel range as a warning is handled with setting the velocity command value to zero.

The drive does not turn off its internal drive enable. If the error condition is still present, that is, if the limit switch is still activated or if the axis limits are still exceeded, only command values that go back into the allowable range will be accepted. Monitoring the command values is dependent on the active operating mode. (See previous chapter.)

Travel Zone Limit Switch Monitoring

The state of the travel range limit switch is illustrated in parameter **P-0-0222, Status Inputs travel range limits**. Bit 0, in this case, is the positive end switch, bit 1 the negative one.

The monitor for exceeding the travel zone limit switch is only activated if

- the monitor is switched on in bit 1 of **P-0-0090, Travel limit parameter**

Exceeding the travel zone limit switch is recognized when these are activated. The diagnostic message depends on the type of reaction:

How handled:	SS display:	Diagnostic message:
As an error	F643	**F643 Positive travel limit switch detected**
	F644	**F644 Negative travel limit switch detected**
As a warning	E843	**E843 Positive limit switch activated**
	E844	**E844 Negative limit switch activated**

Fig. 8-43: Diagnostic message when travel zone limit switch is exceeded

Zone Limit Switches - Activation and Polarity

The travel zone limit switches are activated with the parameter **P-0-0090, Travel limit parameter**.

Additionally, the inputs can be inverted in this parameter (0V on E2/3 -> Travel range exceeded).

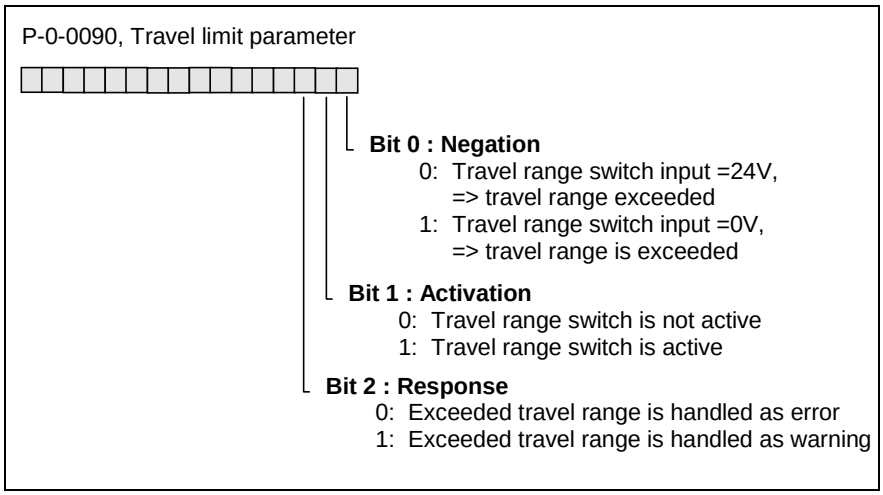

P-0-0090, Travel limit parameter
Bit 0 : Negation
0: Travel range switch input =24V,
=> travel range exceeded
1: Travel range switch input =0V,
=> travel range is exceeded
Bit 1 : Activation
0: Travel range switch is not active
1: Travel range switch is active
Bit 2 : Response
0: Exceeded travel range is handled as error
1: Exceeded travel range is handled as warning

Fig. 8-44: Activating and negating the limit switches (bit 0 or 1)

Axis Limit Values

The monitor for exceeding the axis limit parameters:

- **S-0-0049, Positive position limit value**
- **S-0-0050, Negative position limit value**

is executed only if

- the encoder system of the active operating mode has been homed, i.e. the position encoder values are in relation to the machine's zero point. The **S-0-0403, Position feedback value status** is therefore 1

AND

- the monitor for the axis limit values in **S-0-0055, Position polarities**, bit 4 was activated.

It is recognized that the axis limit values have been exceeded if the position feedback value of the active operating mode exceeds the travel range set by the axis limit values.

Bit 3 of the parameter **S-0-0147, Homing parameter** determines whether the position feedback value of the encoder 1 or of encoder 2 is monitored. If drive-internal interpolation is used as the active operating mode, the drive checks to see if the target position is outside of the axis limit values. If it is, the drive will not move and the warning **E253 Target position out of travel range** is generated, and bit 13 in parameter **S-0-0012, Class 2 diagnostics** is also set.

The diagnostic message for the case that the axis limit values have been exceeded depends on the type of reaction:

How handled:	SS display:	Diagnostic message:
As an error	F629	**F629 Positive travel limit exceeded**
	F630	**F630 Negative travel limit exceeded**
As a warning	E829	**E829 Positive position limit exceeded**
	E830	**E830 Negative position limit exceeded**

Fig. 8-45: Diagnostic message when axis limits have been exceeded

Axis Limit Values - Activation

The axis limit value monitor is activated in bit 4 of **S-0-0055, Position polarities**.

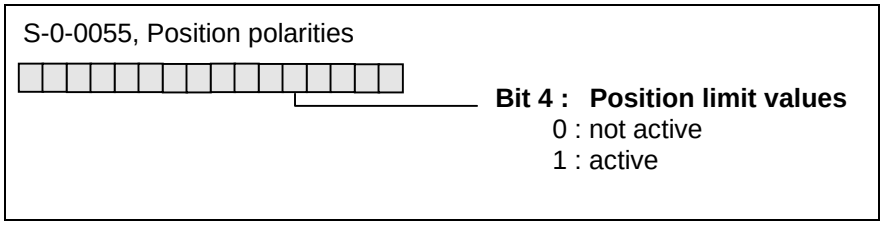


Fig. 8-46: Activating the axis limits

Travel Zone Limit Switches - Connection

see project planning

8.5 Drive Error Reaction

The error response depends on the current error class.

If an error is recognized in the drive controller, a preset error response occurs.

This drive error response depends on

- the error class of the current error
- and the setting of the parameters

- P-0-0117, NC reaction on error

- P-0-0118, Power off on error

- P-0-0119, Best possible deceleration

Note: The error class defines the behavior in the event of a fault.

There are 4 error classes, which have different priorities.

(see also "Error Classes")

Error Class	Diagnostic Messages	Drive Response
Fatal	F8xx	The error response parameter settings in **P-0-0117, NC reaction on error** and **P-0-0119, Best possible deceleration** will be ignored, since a driver response is impossible. Torque/force is instantly cut off.
Travel range	F6xx	Independently of the settings in parameters **P-0-0117, NC Reaction on Error** and **P-0-0119, Best possible deceleration**, the velocity command value is immediately set to zero. This response corresponds to the settings P-0-0117 = 0 (no NC Reaction) P-0-0119 = 0 (Velocity Command Value Reset). This setting provides the fastest stop of the axis if the drive range is exceeded.
Interface	F4xx	A response from the control is impossible, since the communication to the control became inoperative. The drive proceeds instantly with **P-0-0119, Best possible Deceleration**.
Non-fatal	F2xx F3xx	The drive conducts the decel procedure set in **P-0-0117, NC reaction on error** and **P-0-0119, Best possible deceleration.** If NC reaction is set as an error response, then the drive continues to operate for 30 seconds after detecting an error, as if no error had been detected. The NC has this time to bring the axis to a controlled standstill. The drive then conducts the response set in P-0-0119.

Fig. 8-51: Error Response of the Drive

Best Possible Deceleration

The drive reaction **P-0-0119, Best possible deceleration** is conducted automatically with

- interface errors F4xx
- non-fatal errors F2xx

At the end of each error response, the drive's torque is cut off.

- fatal errors F8xx
- travel range errors F6xx

Thus, **P-0-0119, Best possible deceleration** is ignored.

The following settings are possible:

Value of P-0-0119:	Response
0	Velocity Command Value Reset
1	Torque Disable
2	Velocity command value to zero with command ramp and filter
3	Return motion

Fig. 8-52: Setting options for Best possible Deceleration

The drive response, which is defined as "Best possible Deceleration," controls the response of the drive if

- the drive enable signal changes from 1 to 0 (disable the drive enable)
- the operating mode is switched to parameter mode while the drive is enabled. (Reset of the communication phase)

Velocity Command Value Reset

Best possible standstill P-0-0119 = 0

Given an error, the drive will stop with command value = 0. The drive stops with its maximum permissible torque.

(See also section: "Current Limit".)

zeitlicher Ablauf der Fehlerreaktion bei vorhandener Spindelbremse

The procedure for the motor brake activation (if mounted) and the power stage enable with velocity command value deceleration to zero (with spindle brake) are displayed below.

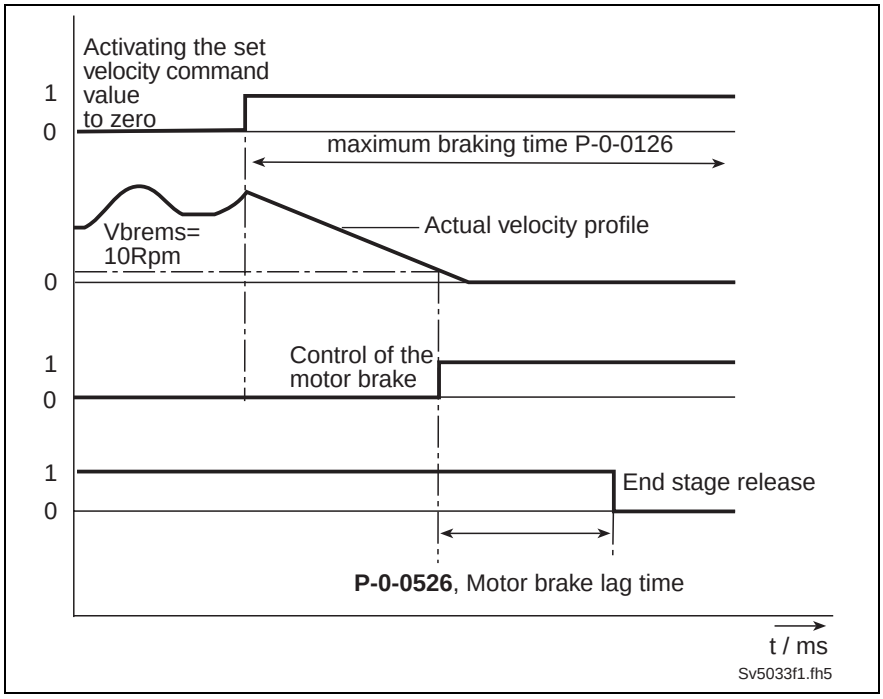


Fig. 8-53: Time sequence of the velocity command value reset

Note: Activation of the motor holding brake depends on P-0-0525, bit 1.
See section: "Motor Holding Brake“

Note: If the value entered in P-0-0126 is too small, then the error reaction could be terminated without axis standstill.



WARNING

If **P-0-0126, Maximum braking time** is set too low:
Danger of damaging the motor brake
⇒ The value for **P-0-0126, Maximum braking time** must always be set higher than the time needed to decelerate the axis with the velocity command value reset, taking maximum possible velocity into account.

Disable Torque

Best possible standstill P-0-0119 = 1 or fatal error

In the event of an error, the drive goes torque free and is braked only by the frictional force, i.e., it "coasts". The actual time to standstill can be considerable.

Note: The error reaction "Torque disable“ is absolutely necessary with fatal errors (F8xx) because braking with a defective end stage or feedback is no longer possible!



DANGER

Drive continues to move unbraked with error!
Danger to life from parts in motion if safety doors are open at the machining cells!
⇒ Check drive for motion (e.g., using **S-0-0040**, **Velocity feedback value,** if possible) and await standstill!

Note: Activation of the motor holding brake depends on P-0-0525, bit 1.
See section: "Motor holding brake“.

The temporal behavior of the brake in conjunction with an error reaction depends on the brake.

Spindle brake

The motor holding brake is not activated until the motor speed drops **below 10min^{-1}**.

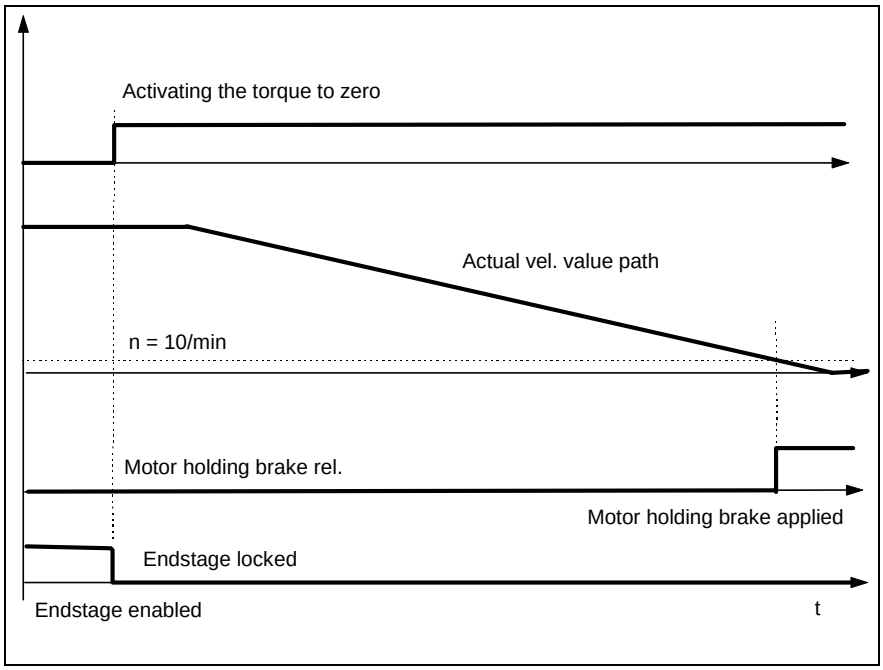


Fig. 8-54: Time diagram with torque to zero and **P-0-0525, Type of motor brake, Bit 1 = 1**

Servo brake The motor holding brake is immediately activated!

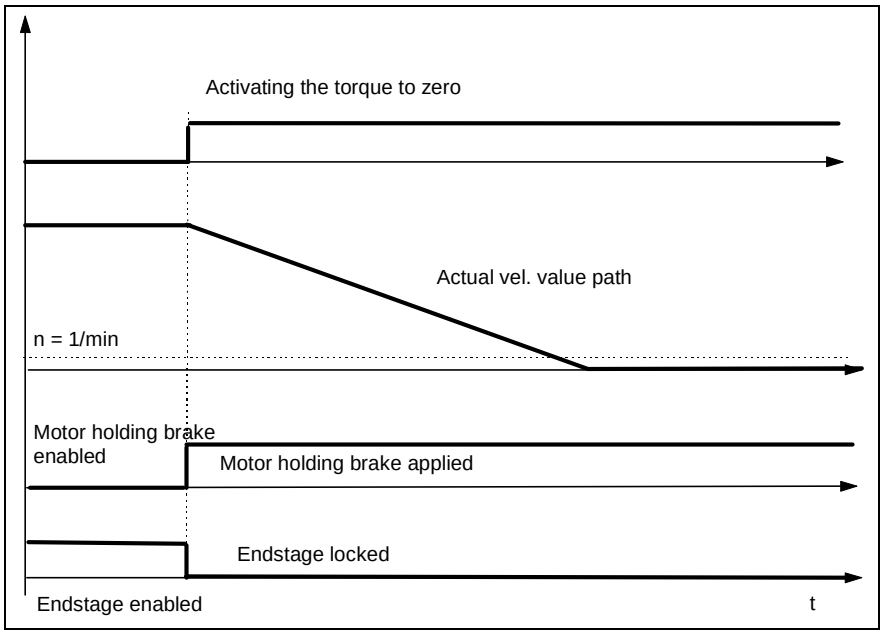


Fig. 8-55: Time diagram with torque to zero and **P-0-0525, Type of motor brake, Bit 1 = 0**

See section: "Motor holding brake".

Velocity command value to zero with filter and ramp

Best possible standstill P-0-0119 = 2

In the event of an error, the drive is brought to a standstill with velocity control with a command value ramp with end value zero. The velocity command value passes through a jerk-limiting command value smoothing filter.

The parameters used in this case are:

- **P-0-1201, Ramp 1 pitch**
- **P-0-1202, Final speed of ramp 1**
- **P-0-1203, Ramp 2 pitch**
- **P-0-1222, Velocity command filter**

These parameters work as described in section: "Operating Mode: Velocity control".

Note: Activation of the motor holding brake depends on **P-0-0525,** bit 1
See section: "Motor Holding Brake“.

The temporal behavior of the brake in conjunction with an error reaction depends on the brake type.

Spindle brake

The **motor holding brake** is always activated when the actual speed drops below **10 rpm** or **10mm/min** (linear motor).

The **end stage** is then deactivated in delayed fashion in terms of what is set in **P-0-0526, Brake control delay**.

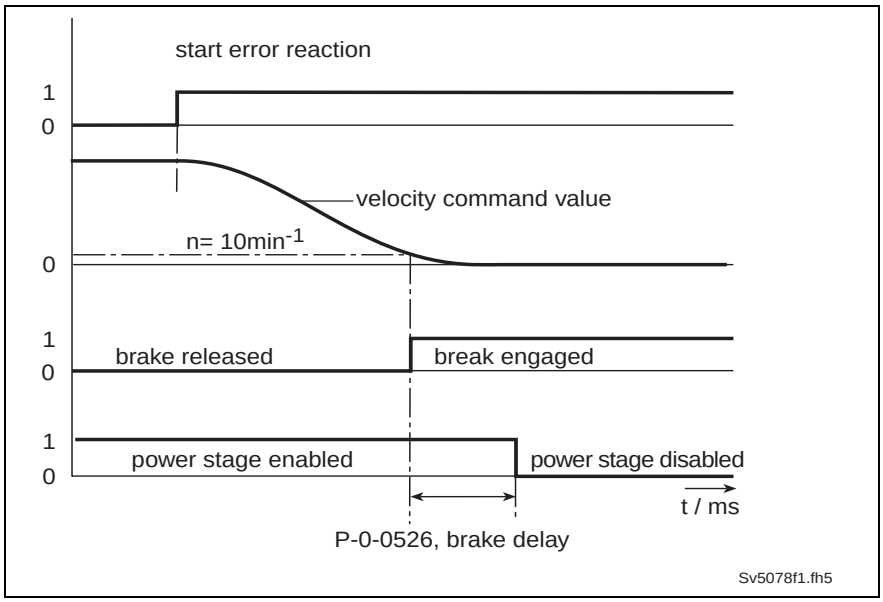


Fig. 8-56: Time diagram with command value to zero with filter and ramp and P-0-0525, Holding brake type, bit 1 = 1 (spindle brake)

ATTENTION

If the value in **P-0-0126, Maximum braking time** is set too small, then the error reaction is terminated and the motor brake will be activated at a speed greater than 10 RPM. This will damage the brake!

Return motion

If a 3 has been set for "Best possible Deceleration" as a return motion, then the drive generates a position command profile to complete the desired travel distance in the case of an error. In other words, in the case of an error a specific process (travel) block is activated.

This travel block is defined by the parameters

- **P-0-0096, Distance to move in error situation**
- **S-0-0091, Bipolar velocity limit value**
- **S-0-0138, Acceleration bipolar**
- **S-0-0349, Jerk limit bipolar**

Once the drive has covered the distance, i.e., has reached the desired target position, then the motor holding brake is activated (if mounted) and the drive is switched torque free at the end of the motor brake delay time. The distance to move is considered as completed, i.e., the motor holding brake is activated, if

- target position = active position command value, i.e., bit 12 in **S-0-0013, class 3 diagnostics** = 1 and
- Vactual = 0, i.e., bit 1 in **S-0-0013, class 3 diagnostics** = 1 (feedback velocity smaller than **S-0-0124, Standstill window**).

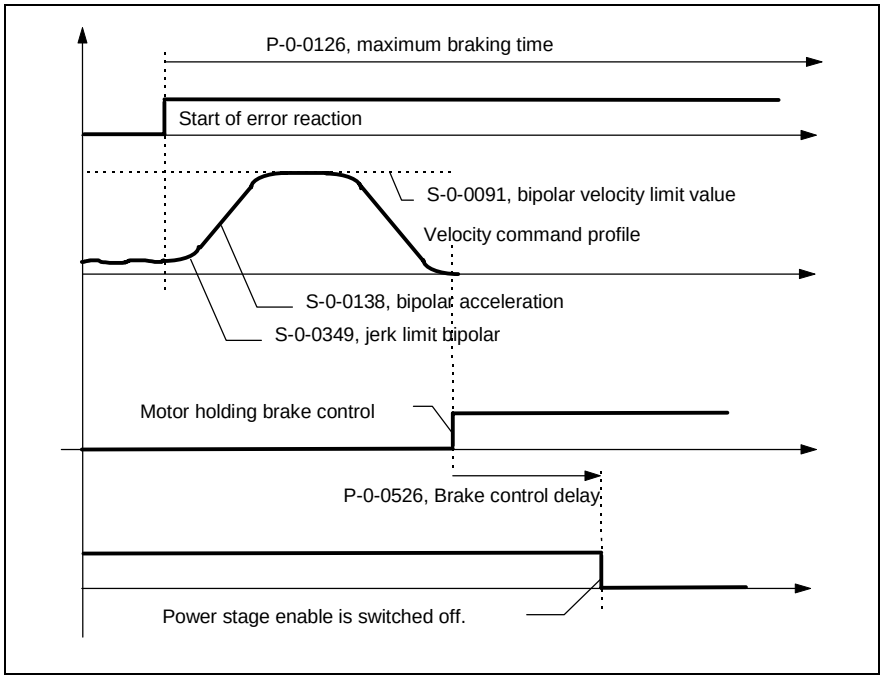

P-0-0126, maximum braking time
Start of error reaction
S-0-0091, bipolar velocity limit value
Velocity command profile
S-0-0138, bipolar acceleration
S-0-0349, jerk limit bipolar
Motor holding brake control
P-0-0526, Brake control delay
Power stage enable is switched off.

Fig. 8-57: Time sequence of the error reaction "return motion“

Error reaction "Return motion" with position limit values activated

If the drive-internal position limit values (**S-0-0049, positive position limit value and S-0-0050, negative position limit value**) have been activated, in other words,

- in **S-0-0055, position polarity parameter** bit 4 for "activating the position limit value" has been set to 1 and
- the encoder set in **S-0-0147, homing parameter, bit 3** is in reference (**S-0-0403, position status** = 1),

then the drive will not leave the travel range set when executing the error reaction "return motion".

Note: If the drive is in a position that would take it outside of the position limit values when executing a return motion, then the drive will, in this case, move to a position just in front of the relevant position limit value (precisely by S-0-0057, Positioning window in front of the position limit value.

Power off on error

BB contact

Project planning prescribes that power must be turned on via the BB contact. This means that power can only be switched on if the BB relay is closed. On the other hand, powering up requires the BB contact to open.

The signalling of a drive error to the drive package or the power supply module can be activated via parameter **P-0-0118, Power off on error** Communication utilizes signal **BBdrive** (X11/5 and X11/14).

The Structure of the Parameter:

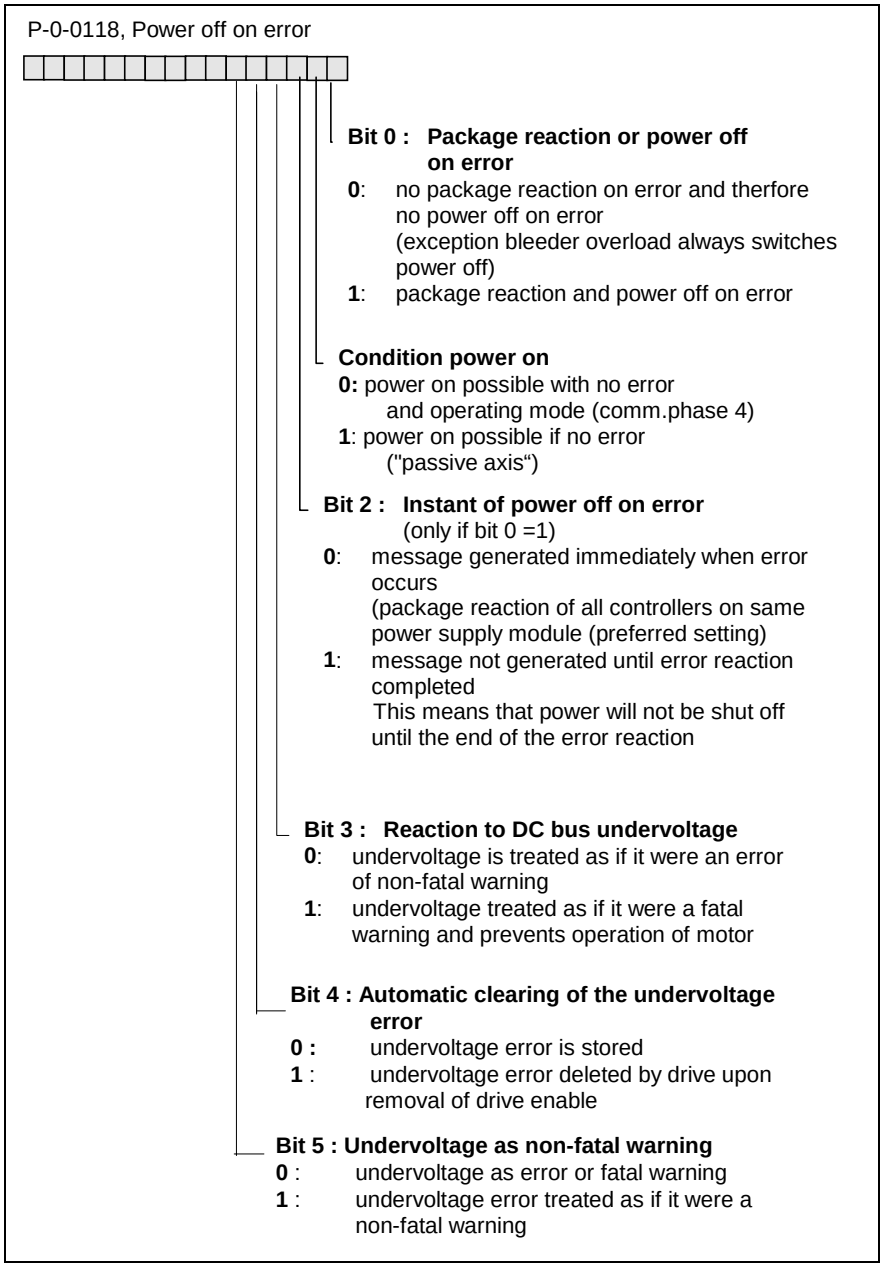

P-0-0118, Power off on error
Bit 0 : Package reaction or power off on error
0: no package reaction on error and therfore no power off on error (exception bleeder overload always switches power off)
1: package reaction and power off on error
Condition power on
0: power on possible with no error and operating mode (comm.phase 4)
1: power on possible if no error ("passive axis“)
Bit 2 : Instant of power off on error (only if bit 0 =1)
0: message generated immediately when error occurs (package reaction of all controllers on same power supply module (preferred setting)
1: message not generated until error reaction completed This means that power will not be shut off until the end of the error reaction
Bit 3 : Reaction to DC bus undervoltage
0: undervoltage is treated as if it were an error of non-fatal warning
1: undervoltage treated as if it were a fatal warning and prevents operation of motor
Bit 4 : Automatic clearing of the undervoltage error
0 : undervoltage error is stored
1 : undervoltage error deleted by drive upon removal of drive enable
Bit 5 : Undervoltage as non-fatal warning
0 : undervoltage as error or fatal warning
1 : undervoltage error treated as if it were a non-fatal warning

Fig. 8-58: P-0-0118, Power off on error

Power off and package reaction on error

Signal line "BBdrive"

In the case of drive packages (this is defined as a collection of multiple drives that have a power supply common to all and which can execute errors commonly), it is possible to inform the individual controllers and any power supply module which may be present as to whether the drive has detected an error as a result of which the power source must be shutdown. This communication utilizes **signal line "BBdrive"** (x11/5 and X11/14). If the controllers without error detect the error state on the signal line BB drive, then they will, in turn, also conduct the error reaction and shut power off.

The point in time at which the drive package is signalled (at start or end of the error reaction) is set in bit 2.

Condition for Power On

Using bit 1 of **P-0-0118, Power off on error** it is possible to set that point in time at which the drive signals its readiness to operate and therefore at which power can be switched on.

passive axis

If **bit1 =** 1, then power can be switched on immediately after initialization of the drive, in other words, in communication phase 0 ("passive axis“).

If **bit1 = 0**, then the drive must be in communications phase 4 and without error before the power can be switched on for the first time.

In units that cannot release energy generated during brake (by means of bleeders or a mains-regenerated power supply) bit 2 should be set to 1 to prevent the drive coasting.

Reaction to Undervoltage (DC bus voltage too small)

Bits 3, 4 and 5 of **P-0-0118, Power off on error** offer various options on how to handle Undervoltage.

Undervoltage is present if the drive has been enabled (subject to torque) and the DC bus voltage drops below the minimum value (about 75% of the mean value of a periodic quantity).

Undervoltage as fatal warning

Using **Bit3 = 1** treats undervoltage as a "fatal warning".

This makes sense if the energy in the DC bus must be retained for that period of time which a control needs to start a synchronized deceleration of several drives.

The drive does not signal a class 1 diagnostics error and the reaction parametrized in **P-0-0119, Best possible deceleration** is also not conducted.

Switching the motor off leads to a slower drop in the DC bus voltage. This means that asynchronous motors can still have a magnetic field when the control starts the synchronized deceleration of the drive. Braking then takes place in generator mode.

Automatic deleting of the undervoltage

If undervoltage is treated as an error (bit 3, 5 = 0), then bit 4 can be used to set an automatic delete of the error once the control removes the drive enable signal.

This makes sense if the error occurs even with normal shutdowns and the cause is simply that the drive does not remove the enable fast enough.

Undervoltage as warning

Using **Bit5 = 1** it is possible to switch off every response to undervoltage in the DC bus, mains errors or mains section errors. Only one warning is generated.

Note: If the DC bus voltage does not rise above the undervoltage threshold within 100ms, then error F226 Undervoltage is generated in the power section.

NC Response in Error Situation

NC response during an error situation is only possible during non-fatal errors. Otherwise the drive reacts immediately with an error response.

If the drive control device recognizes an error, it sends a message to the control (CNC) . The control can then decelerate the servo axis of the machine without possible damage.

If this is desired, you have to delay the drive error reaction to allow the axis to continue movement to the values set by the control. This is achived by setting the time delay between the recognition of the error and the drive's error reaction. This can be set in parameter **P-0-0117, NC Reaction on Error**.

The following applies:

Value of P-0-0117	Function
0	Drive proceeds the error reaction immediately after recognition of the error.
1	Drive continues for 30 sec in the selected operating mode, then follows the "best possible deceleration".

Fig. 8-59: NC Reaction on Error

Note: Activating the "NC Reaction on Error" is only recommended for controls that have a corresponding error reaction procedure.

Emergency stop feature

The E-Stop function supports the braking of the drive via a hardware input on the drive controller. It thus represents the option of shutting down the drive parallel to command communication, in an emergency.

Activation and the how to set the deceleration:

The following parameters are used:

- **P-0-0008, Activation E-Stop function**
- **P-0-0223, Status Input E-Stop function**

Functional principle of the E-Stop function

By activating the E-Stop function (bit 0 = 1) the drive executes, upon actuation of the E-stop input, the selected reaction for deceleration. This reaction depends on bit 2 of P-0-0008.

After activation of the E-Stop Input (bit 0 = 1), the drive is prompted to perform the selected procedure to shutdown the drive. This reaction at first depends on bit 2 of P-0-0008.

Interpretation as warning E834 Emergency-Stop active

If the interpretation "fatal warning" has been parametrized there (bit 2 = 1), then the drive responds as with switching off the external drive enable with the reaction parametrized in **P-0-0119, Best possible deceleration**. The warning diagnosis **E834 Emergency-Stop** appears. Bit 15 is set in **S-0-0012, Class 2 diagnostics** (manufacturer specific warning). Simultaneously, the bit "change bit class 2 diagnostics“ is set in the drive status word. This change bit is cleared by reading **S-0-0012, Class 2 diagnostics.**

The functional principle at work when actuating the E-Stop input is that of a series connection to an external drive enable. When activating the E-Stop input, the drive responds as if the external drive enable switched off.

To re-activate the drive, the E-Stop input must become inactive, and another 0-1 edge must be applied to the external drive enable.

Interpretation als error with adjustable reaction

If bit 2 has been set to treat it as an error, then the reaction selected in bit 1 is performed. The error diagnosis **F434 Emergency-Stop** (or **F634 Emergency-Stop**), E-stop activated appears, and bit 15 is set in parameter **S-0-0011, Class 1 diagnostics** . Bit 13 is set in the drive status word of the drive telegram, i.e., drive interlock, error with class 1 diagnostics is set. The error can be cleared via command **S-0-0099, C500 Reset class 1 diagnostic, or** key S1 on the drive controller if the E-stop input is no longer activated.

This function basically works as if an error had occurred in the drive. The drive reaction is immediate and without delay, independent of parameter **P-0-0117, NC reaction on error.**

F434 Emergency-Stop active

If bit 1 = 0, the drive shuts down according to **P-0-0119, Best possible deceleration**. The diagnosis upon activating the E-stop input then reads **F434 Emergency-Stop.**

Status of the Emergency-Stop Input

Interpretation as error with reaction as "Velocity command value to zero"

If bit 1 is set to 1 , then the drive is braked at maximum torque, if an E-Stop of the drive is triggered, until the speed = 0, regardless of the error reaction set in parameter P-0-0119. This corresponds to the best possible standstill "Velocity command value to zero". The diagnosis with the activation of the E-Stop input then reads **F434 Emergency-Stop.**

The state of the E-Stop input can be controlled via parameter **P-0-0223, Status Input E-Stop function**. The state of the E-stop input is stored there in bit 0.

Activation and Polarity of the E-Stop Input

For the activation of the E-Stop input and the selection of a response for shutdown of the drive, use parameter **P-0-0008, Activation E-Stop function**.

The following applies:

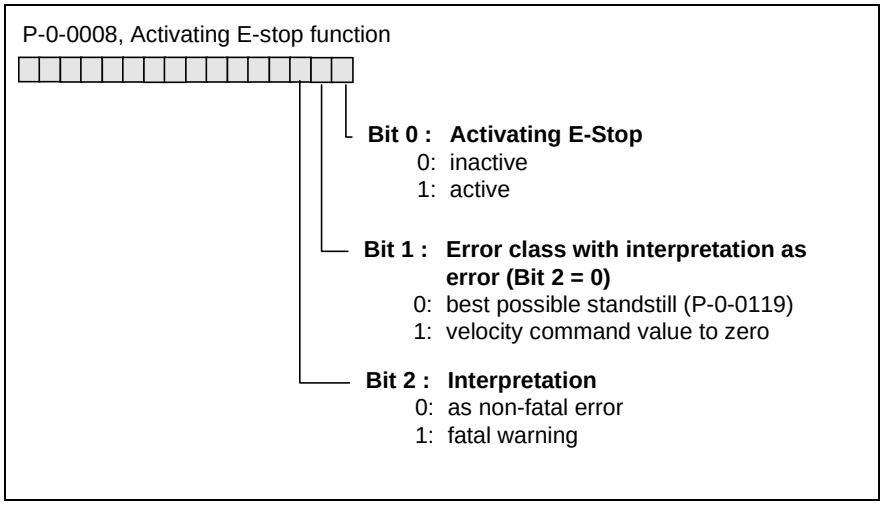

P-0-0008, Activating E-stop function
Bit 0 : Activating E-Stop
0: inactive
1: active
Bit 1 : Error class with interpretation as error (Bit 2 = 0)
0: best possible standstill (P-0-0119)
1: velocity command value to zero
Bit 2 : Interpretation
0: as non-fatal error
1: fatal warning

Fig. 8-60: P-0-0008, Activation of E-Stop-Function

Connection of the Emergency-Stop Input

see project planning manual.

8.6 Control Loop Settings

General Information for Control Loop Settings

"Optimizing" the regulator settings is generally not necessary!

The control loop settings in a digital drive controller are important for the characteristics of the servo axis.

Determining the control loop settings requires expert knowledge. For this reason, application-specific control parameters are available for all digital INDRAMAT drives. These parameters are either contained in the feedback data memory and can be activated through the command **S-0-0262, C700 Command basic load** (with MHD, MKD and MKE motors) or they must be input via the setup/service program. (See also Load Default Feature)

In some exceptions, however, it may be necessary to adjust the control loop settings for a specific application. The following section gives a few simple but important basic rules for setting the control loop parameters in such cases.

In every case, the given methods should only be seen as guidelines that lead to a robust control setting. Specific aspects of some applications may require settings that deviate from these guidelines.

The control loop structure is made up of a cascaded (nested) **position, velocity and torque/force loop**. Depending on the operating mode, only the torque control loop or the torque and velocity control loops can become operative. The control is structured as depicted below:

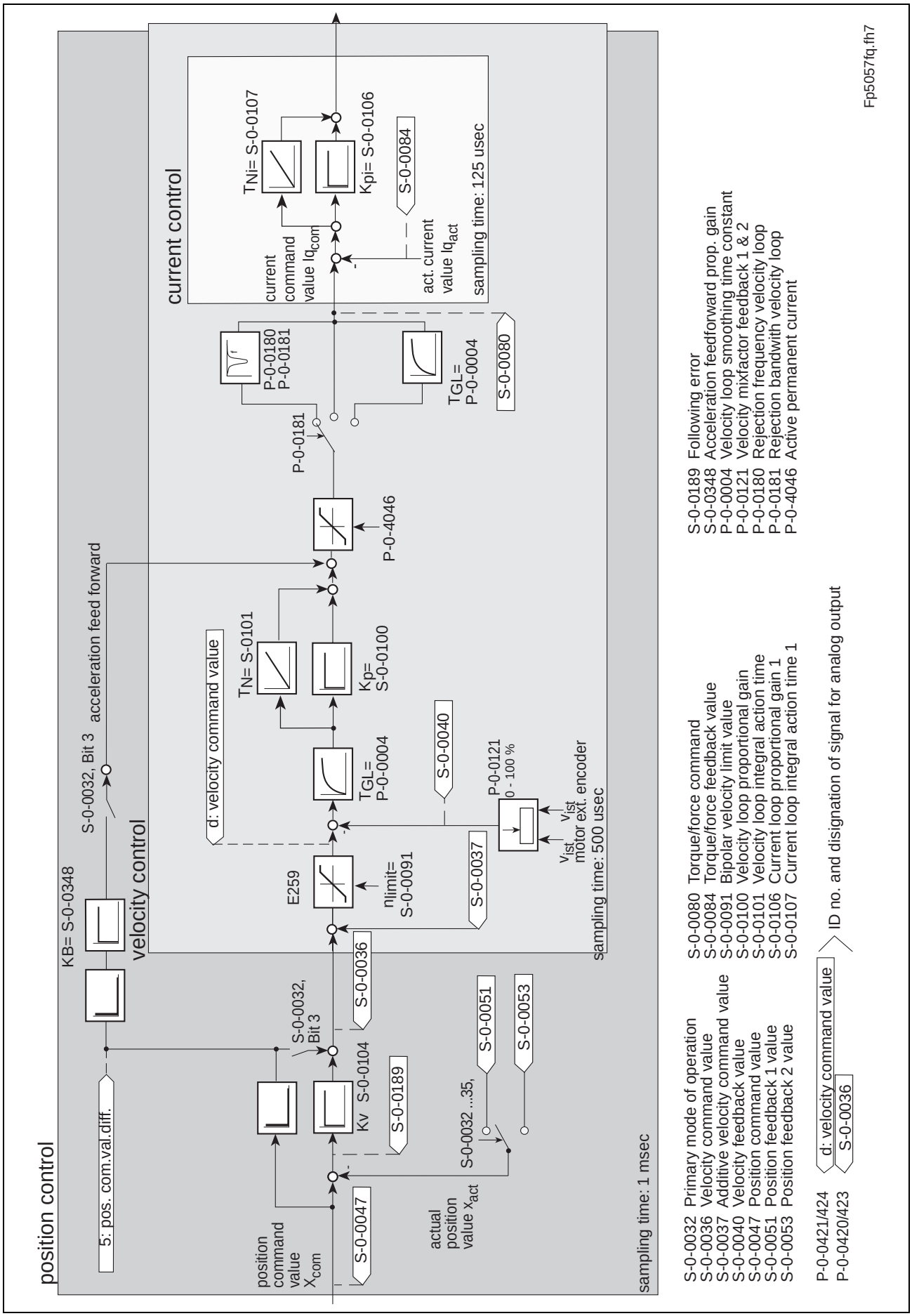


Fig. 8-61: Control structure

Load Default

With the command **Basic Load**, you can activate the default control parameters for motor types with **motor feedback data memory** such as

- MHD
- MKD
- MKE

With these parameters, the relevant control parameters for the appropriate motor type used can be set.

Note: The parameters are pre-defined by the manufacturer for the moment of inertia relationship of $J_{own} = J_{load}$.

Most applications can work with these values.

Default values can be set for the following parameters:

- **S-0-0106, Current loop proportional gain 1**
- **S-0-0107, Current loop integral action time 1**
- **S-0-0100, Velocity loop proportional gain**
- **S-0-0101, Velocity loop integral action time**
- **P-0-0004, Smoothing Time Constant**
- **S-0-0104, Position loop Kv-factor**
- **P-0-0181, Rejection bandwidth velocity loop**

The feature **Load Default Settings** can be activated in two different ways:

- Automatic activation during the command procedure **S-0-0128, C200 Communication phase 4 transition check** for the first operation of this motor type with this drive.
- With the command procedure **S-0-0262, C700 Basic Load**

Automatic Execution of the Load Default Feature

If a controller has been operated with a specific type of motor, then the controller will detect this from that point forward. During the execution of command **S-0-0128, C200 Communication phase 4 transition check** it compares parameter **S-7-141, Motor type**, which is read out of the data memory, with the value for parameter **S-0-0141, Motor type** which is backed up in the parameter memory of the controller. If these two parameters are different, then error **F208 UL The motor type has changed** is generated. "UL" appears in the 7-segment display.

Note: Before the user can reset the error and thus start the base load function, the option of secure a specific set of controller parameters is available.

Error **F208 UL The motor type has changed** can be reset in three different ways:

1.) executing the command
S-0-0099, C500 Reset class 1 diagnostic

2.) Actuating key S1

3.) Applying 24 V at error reset input

In alla three cases, the load base values function is activated.

If the execution of load base values is not posible, then the relevant command error of command **S-0-0262, C700 Command basic load** will appear**.**

(Also see section: "Error causes when executing load base value function").

Run the Load Default Settings feature as a command

With parameter **S-0-0262, C700 Basic load**, the feature can be run as a command. This might be useful if manually changed control parameters are to be set back to the default values.

Error Conditions of the Load Default Settings Procedure

If the feature started by running the command **S-0-0262, C700 Basic load** is not successfully processed, then the reason for this error is displayed either on the 7-segment display or with the diagnostic parameter **S-0-0095**.

The following could cause an error during basic load:

SS Display	Diagnostic Message:	Cause:
C702	Default parameters not available	Basic load (or load defaults) is impossible for the motor type selected, only for MHD-, MKD and MKE
C703	Default parameters invalid	Connection of drive to motor encoder data memory is interrupted or feedback is defective
C704	Parameters not copyable	The existing default value cannot be processed since, for example, the extreme value limit was exceeded in the default value
C705	Locked with password	A customer password has been set which locks out changes to parameters

Fig. 8-62: Possible errors during Basic Load command

Note: If a parameter can not be set on its default value, the parameter is set invalid in its data status. This serves safety purposes and helps in diagnosing errors.

Setting the Current Controller

The parameters for the current loop are set by INDRAMAT and cannot be adjusted for specific applications. The parameter values set at the factory are activated with the command **S-0-0262, C700 Command basic load** for MKD/MHD motors or must be retrieved from the motor data sheet.

The parameters for the current controller are set via the parameters

- **S-0-0106, Current loop proportional gain**
- **S-0-0107, Current Loop Integral Action Time**



Warning

Changing the values defined by INDRAMAT
can result in damages to the motor and the drive controller.
⇒ Changes to the current controller parameters are not permitted.

Setting the Velocity Controller

Pre-requisites: The current control must be correctly set.

The velocity controller is set via the parameters

- **S-0-0100, Velocity Loop Proportional Gain**
- **S-0-0101, Velocity Loop Integral Action Time**
- **P-0-0004, Smoothing Time Constant**

as well as the parameters

- **P-0-0180, Rejection frequency velocity loop**
- **P-0-0181, Rejection bandwidth velocity loop**

The setting can be made by:

- conducting the load base values function once
- in accordance with the procedure described below
- by starting the command "automatic control loop settings"

Preparations for Setting the Velocity Controller

A number of preparations must be made in order to be able to set the velocity loop (controller):

- The mechanical system must be set up in its final form in order to have original conditions while setting the parameters.
- The drive controller must be properly connected as described in the user manual.
- The safety limit switches must be checked for correct operation (if available)
- The velocity control operating mode must be selected in the drive.

Start settings The controller setting must be selected for the start of parameterization as follows:

S-0-0100, Velocity Loop Proportional Gain = default value of the connected motor.

S-0-0101, Velocity Loop Integral Action Time = 6500 ms (no integral gain)

P-0-0004, Smoothing Time Constant = Minimum value (= 500µs)

P-0-0181, Rejection bandwidth velocity loop = 0 Hz (deactivated)

Note: When determining the velocity control parameters, no compensation function should be active.

Definition of the Critical Proportional Gain and Smoothing Time Constant

- After turning on the controller enable, let the drive move at a low velocity. Rotational motors: 10...20RPM, linear-Motors: 1...2 m/min)
- **Raise the S-0-0100, Velocity loop-proportional gain** until unstable behavior (continuous oscillation) begins.
- Determined the frequency of the oscillation by oscilloscoping the actual velocity (see also "Analog Output"). If the frequency of the oscillation is much higher than 500Hz, raise the **P-0-0004, Smoothing Time Constant** until the oscillation ends. After this, increase the **S-0-0100, Velocity Control Proportional Gain** until it becomes unstable again.
- **Reduce the S-0-0100, Velocity loop proportional gain** until the oscillation ends by itself.

The value found using this process is called the "**critical velocity loop proportional gain".**

Determining the Critical Integral Action Time

- **Set S-0-0100, Velocity loop proportional gain** = 0.5 x critical proportional gain
- **Lower S-0-0101, Velocity loop integral action time** until unstable behavior results.
- **Raise S-0-0101, Velocity loop integral action time** until continuous oscillation vanishes.

The value found using this process is called the "**Critical Integral Action Time."**

Determining the Velocity Controller Setting

The critical values determined before can be used to derive a control setting with the following features:

- Independent from changes to the axis since there is a large enough safety margin to the stability boundaries.
- Safe reproduction of the characteristics in series production machines.

The following table shows many of the most frequently used application types and the corresponding control loop settings.

Application Type:	Velocity controller proportional gain	Velocity loop Integral Action Time:	Comments:
Feed axis on standard tool machine	Kp = 0.5 • Kpcrit	Tn = 2 • Tncrit	Good stiffness and good command response
Feed axis on perforating press or chip-cutter machines	Kp = 0.8 • Kpcrit	Tn = 0	High proportional gain; no I-part, to achieve shorter transient periods.
Feed drive for flying cutting devices	Kp = 0.5 • Kpcrit	Tn = 0	Relatively undynamic control setting without I-part, to avoid structural tension between the part to cut off and the machine.

Fig. 8-63: Identification of Velocity Controller Settings

Filtering oscillations from mechanical resonance

The drives are able to suppress oscillations caused by the drive train (gear) between the motor and the axis or by the spindle mechanics even in a narrow band. Thus, an increased drive dynamics with good stability can be achieved.

The mechanical system of rotor-drive train-load is induced to generate mechanical oscillations as a result of position/velocity feedback in a closed control loop. This behavior identified as a "two mass oscillator" is generally within the 400 to 800 Hz range, depending on the rigidity (or elasticity) and spatial volume of the mechanical system.

This "two mass oscillation" usually has a clear resonance frequency which can be specifically suppressed by a notch filter (band suppressor) provided in the drive.

By suppressing the rejection frequency the dynamics of the velocity and position control loops in terms of control can be significantly improved compared to without a band suppression filter.

This results in greater contour accuracy and smaller cycle times for positioning processes, leaving sufficient stability margin.

The rejection frequency and bandwidth can be set. The rejection frequency is the one with highest attentuation, the bandwidth determines the frequency range, at whose borders the attenuation is 3dB less. Greater bandwidth leads to smaller band attenuation of the center frequency!

The following parameters can be used to set both:

- **P-0-0180, Rejection frequency velocity loop**
- **P-0-0181, Rejection bandwidth velocity loop**

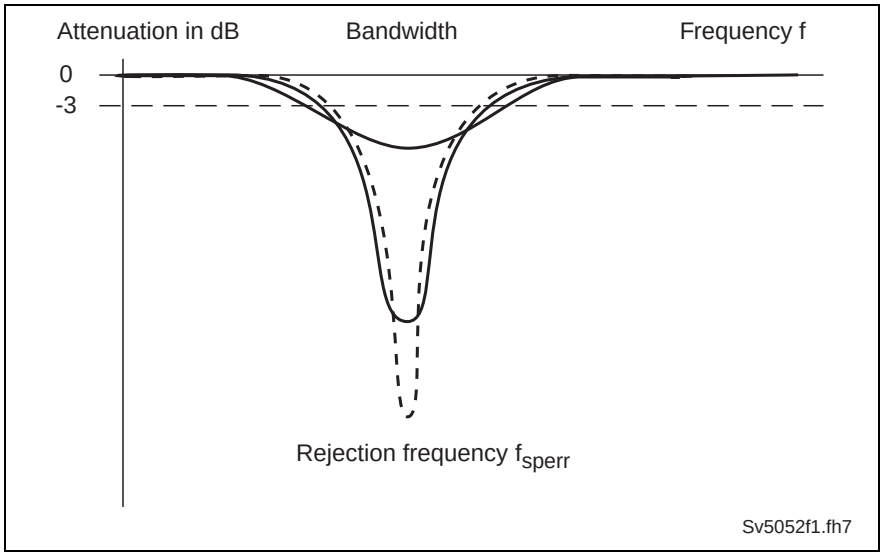


Fig. 8.64: Amplitude response of the rejection filter in terms of bandwidth - qualitative

To set the band filter, we recommend the procedure described as follows:

Pre-settings

⇒ Set rejection filter inactive. Set 0 in parameter **P-0-0181 Rejection bandwidth velocity loop.**

Determing resonance frequency

⇒ Connect oscilloscope to analog output channels. Assign velocity feedback value to analog output 1 (in **P-0-0420, Analog output 1, signal selection** "S-0-0040" and in **P-0-0422, Analog output 1 scaling** enter the scaling, e.g., 100 Rpm / 10 Volts.

- or -

⇒ Use the oscilloscope function of the drive to display velocity feedback value.

⇒ Excite the drive mechanics, e.g., tap lightly with a rubber hammer.

⇒ Record the time of the velocity oscillations with an oscilloscope or oscilloscope function and analyze the clearly salient frequencies. If the oscilloscope function is used, then the resonance frequency can be directly read out of the frequency readout.

Determining the initial state of the loop

⇒ Set the drive enable signal and optimize the velocity loop with inactive rejection filter (see "Setting the Velocity Controller").

⇒ Record step response of the velocity feedback and the torque/force generating command current with a small velocity command step. (The torque-generating command current may not enter the limit during this process.)

Turn rejection filter on and check the effect

⇒ Enter the most salient frequency in Hz in parameter **P-0-0180, Rejection frequency velocity loop.**

⇒ Enter a minimum bandwidth in parameter **P-0-0181, Rejection bandwidth velocity loop,** e.g., 25 Hz.

⇒ Record the previous step response again.

If the step response features less overshoot and shorter periods of oscillation, then:

⇒ Check whether increasing the value of **P-0-0181, Rejection bandwidth velocity loop** causes an improvement

- or -

⇒ check whether a change in the value of **P-0-0180, Rejection frequency velocity loop** means an improvement.

If the step response results in the same behavior, then:

⇒ Check the resonance frequency analysis

- or -

⇒ clearly increase the value in **P-0-0181, Rejection bandwidth velocity loop.**

Optimize rejection filter or velocity loop

⇒ with the pre-optimized values of **P-0-0180, Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop,** optimize the velocity controller again (see above).

The step responses defined above must have a similar appearance with higher values for **S-0-0100 Velocity loop proportional gain** and / or smaller values for **S-0-0101 Velocity loop integral action time.**

An additional optimizing run may be necessary for **P-0-0180 Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop** using the step response (see above).

Filtering with double smoothing filter

⇒ Optimization of the control loop with a notch filter (band suppression) does not always make the regulation good enough. This happens for example when the closed loop does not have significant resonance frequencies. Activation of a second smoothing filter (with low pass response) can, depending from the case, improve the regulation quality as desired.

⇒ To do this, set the parameter **P-0-0181, Rejection bandwidth velocity loop** to **-1**. The notch filter as well as the assigned parameter **P-0-0180, Rejection frequency velocity loop** are deactivated. Instead of the notch filter, a smoothing filter is activated in the control loop. This uses the same smoothing time constant T_{gl} as the smoothing filter with **P-0-0004 Velocity loop smoothing time constant**. Together with the smoothing filter at the input of the velocity controller, you obtain a low pass filter of 2nd order (2 poles). Frequencies greater than the cutoff frequency $f_g = 1/2\pi T_{gl}$ are much more suppressed and cannot excite oscillations in the control loop any more. The parameter for the filter is **P-0-0004 Velocity loop smoothing time constant**.

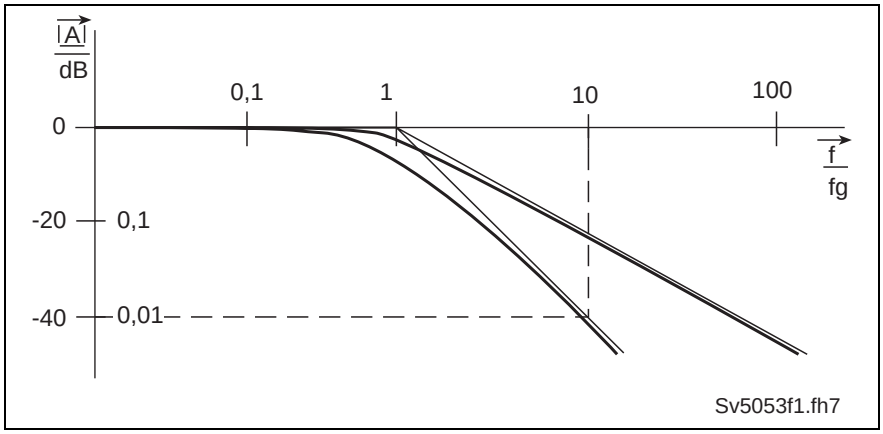


Fig. 8-65: Frequency response of low pass filters with 1 pole and with 2 poles

Note: The adjustment is the same as described under "Definition of the Critical Proportional Gain and Smoothing Time Constant".

Velocity Control Loop Monitoring

If the velocity control loop monitor detects a fault in the velocity control loop then error

- **F878 Error in velocity control loop**

is generated.

Note: The velocity control loop monitor is only active if an operating mode is active with which the velocity control loop in the drive is closed and monitoring activated (always except with torque control**)**.

Activating the monitor

The monitor is activated with parameter **P-0-0538, Motor function parameter 1**.

The structure of the parameter:

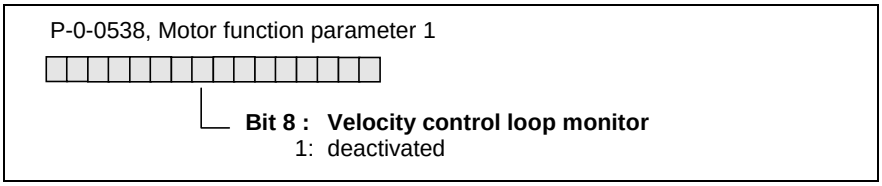


Fig. 8-66: P-0-0538, Motor function parameter 1

See also the parameter description: **P-0-0538, Motor function parameter 1**.

Note: It is highly recommended not to deactivate the velocity control loop monitor activated at the factory as it represents a basic safety function of the drive**!**

The causes of a monitor trigger

The velocity control loop monitor is designed to monitor for those faults that could lead the motor torque in the wrong direction.

The following options are basically possible:

- incorrect poles with motor connection
- wrong commutation angle
- faults in the velocity encoder

Note: This prevents the "runaway effect" of the motor.

Criteria for Triggering the Monitor

The following four criteria must be met for the velocity control loop monitor to be triggered :

- Current command value in the limit
- motor accelerating in the wrong direction
- control deviation > $0.1*n_{Max}$
- and actual velocity control value is > $0.0125*n_{Max}$

Setting the position controller

Pre-requisite: Current and speed control must be correctly set.

The position controller can be set with the parameter

- **S-0-0104, Position Controller Kv Factor**

This can be set by either executing the load default settings procedure or by following the process below.

Preparations for Setting the Position Control Loop

A number of preparations must be made in order to be able to set the position controller properly:

- The mechanical system must completely assembled and ready for operation.
- The drive controller must be properly connected as described in the user manual.
- The safety limit switches must be checked for correct operation (if available)
- Operate the drive in a mode that closes the position loop in the drive (position control).
- The velocity controller must be properly tuned. The start value chosen for the K_v-factor should be relatively small ($K_v = 1$).
- For the determination of the position controller parameter, no compensation function should be activated.

Determing the Critical Position Controller Gain

- Move axis at a slow velocity, i.e., with a jog function at a connected NC Control (Rotating Motors: 10...20 Rpm, linear-Motors: 1...2m/min).
- Raise the K_v-factor until instability appears.
- Reduce the K_v-factor until the continuous oscillation ends by itself.

The Kv factor determined through this process is the "**Critical position control loop gain".**

Determining the Position Controller Setting

In most applications, an appropriate position controller setting will lie between 50% and 80% of the critical position controller loop gain.

This means:

S-0-0104, Position Loop KV-Factor = 0.5..0.8 • K_{vcrit}

Position Control Loop Monitoring

The position control loop monitor helps to diagnose errors in the position control loop.

Reasons for errors in the position control loop can be:

- Exceeding the torque or acceleration capability of the drive.
- Blocking of the axis' mechanical system
- Disruptions in the position encoder

The monitoring of the position circuit is only active when an operation mode with closed position loop is active in the drive.

To set and check the monitoring function, two parameters are used:

- **S-0-0159, Monitoring Window**
- **P-0-0098, Max. Model Deviation**

If the drive detects an error in the position control loop, the error message

- **F228 Excessive deviation**

is issued.

General Operating Characteristics of Position Control Loop Monitoring

To monitor the position control loop, a model actual position value is computed, which depends only on the commanded position profile and the set position loop parameters. This model position is compared continuously to the actual position. If the deviation exceeds **S-0-0159, Monitoring Window** for more than 8msec, an error **F228 Excessive deviation** will be generated.

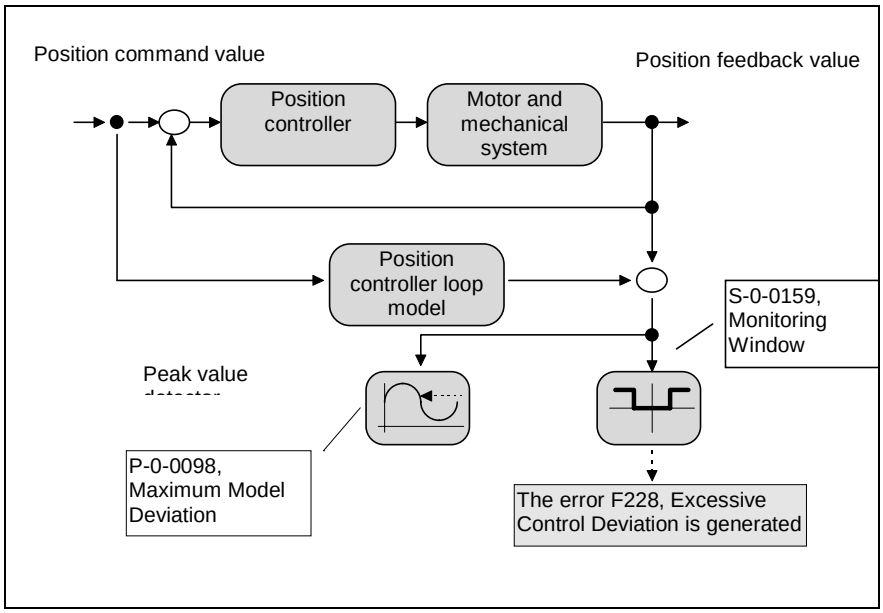


Fig. 8-67: Schematic of Position Control Loop Monitoring

Note: For accurate monitoring, always the actual feedback value from the position control is used. This means that for position control with the motor encoder, position feedback value-1 is used; and for position control with the external encoder, the position feedback value-2 is used.

Setting the Position Control Loop Monitor

Requirements

Requirements for the setup of the position loop monitoring are

- Check the velocity and position control loops for their appropriate settings.
- The axis in question should be checked mechanically and should be in its final state.

settings

The position control loop monitor settings are performed:

- Through the connected control, you should proceed in a typical operation cycle. In this mode, move at the maximum projected velocity.
- In parameter **P-0-0098, Max. Model Deviation**, the maximum deviation between the actual feedback value and the expected feedback value is always displayed. (Note: The contents of this parameter are not saved. After enabling the drive, this parameter equals zero.)
- This value can be used to help set the monitoring window. Parameter **S-0-0159, Monitoring Window** should be set to **P-0-0098, Max. Model Deviation** multiplied by a safety factor. A safety factor between 1.5 and 2.0 is recommended.

Example:

Content of P-0-0098, Maximum Model Deviation:

0.1 mm

⇒ Determination for the parameter S-0-159, Monitoring Window:

0.2 mm (= 2 x 0.1 mm)

Deactivation of the Position Control Loop Monitoring

It is strongly recommended to activate the position loop monitoring. However, there are exceptions for which the position loop monitoring must be deactivated. You can do that with the parameter **S-0-0159, Monitoring Window**, if it is set to very high values.

Note: By default, the Position Control Loop Monitoring is active.

Setting the Acceleration Feed Forward

For Servo applications, where high precision at high speeds counts, you have the option to improve by far the precision of an axis during acceleration and brake phases through activation of the acceleration feed forward.

Typical applications for the use of the acceleration feed forward:

- Free form surface milling
- Grinding

To set the acceleration feed forward, use the parameter

- **S-0-0348, Proportional Gain Acceleration Feed Forward**

This value can be determined as follows.

Requirements for a Correct Setting of the Acceleration Feed Forward

- Velocity and position loop have to be set appropriately.
- For the position controller, a **lagless** operation mode must be selected.

Setting the Acceleration Feed Forward

Setting the correct acceleration feedforward can only be done by the user since it depends on the inertia.

The setting is done in two steps:

Note: With automatic control loop settings it is not only possible to determine inertia but also the value for S-0-0348.

- Calculation of the preset value for the acceleration feedforward. For this purpose, you need the size of the complete inertia momentum translated to the motor shaft ($J_{Motor}+J_{Load}$) of the axis. This value is known approximately from projecting the axis. Additionally, you need the torque constant of the used motor. This data can be retrieved from the motor data sheet or the parameter **P-0-0051, Torque-/Force Constant** Kt. The preset value is calculated as:

$$\text{Acceleration Feedforward} = \frac{J_{Motor} + J_{Actuated}}{Kt} \times 1000$$

Acceleration Feedforward [mA/(rad\s²)]
J*Motor*: Inertia momentum of the motor [kg m²]
J*Load*: Inertia momentum of the load [kg m²]
Kt: Torque constant of the motor [Nm/A]

Fig.8-68: Value for the Acceleration Feedforward

The determined value is entered in parameter **S-0-0348, Acceleration feedforward gain**.

Checking the effect of the acceleration feedforward and, if necessary, **fine tuning** of the parameter **S-0-0348, Acceleration feedforward gain**:

The deviation of the actual feedback value to the position command can be displayed through the analog diagnostic output of the drive controller. To check the effect of the acceleration feed forward, you must oscilloscope the signal during movement of the axis along the desired operation cycle. In acceleration and brake phases, the feedforward must reduce the control deviation drastically.

Setting the Velocity Mix Factor

With the help of the velocity mix factor, you can combine the velocity feedback value, used for velocity control, from the motor and the external measurement system. This might be an advantage, when there is play or torsion between motor and load.

To set the mixing ratio, use the parameter

- **P-0-0121, Velocity Mixfactor Feedback1 & 2**

Precondition: The function is only applicable when ther is an external measurement system. If this is not available, **P-0-0121** is automatically set to 0 % .

The mixture of the velocity feedback value can be continuously varied between:

- 100% Velocity feedback value of the motor encoder
  /
  0% actual value of the external encoder (P-0-0121 = 0)
  and
- 0% Velocity feedback value of the motor encoder
  /
  100% actual value of the external encoder (P-0-0121 = 100 %)

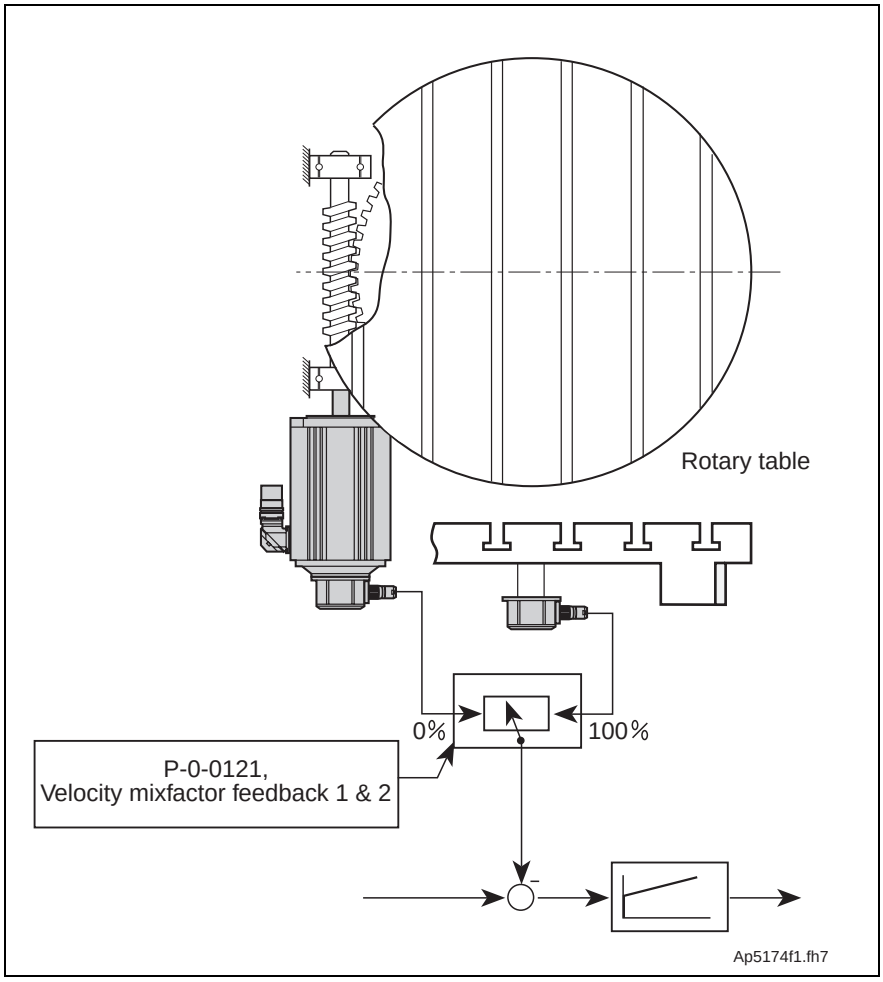


Fig. 8-69: Velocity Mixture Diagram

8.7 Automatic Control Loop Settings

General Comments

To expedite drive parametrization, the firmware offers an automatic control loop setting. Using parameters **P-0-0163**, **Damping factor for autom. control loop adjust** and **P-0-0164**, **Application for autom. control loop adjust**, it is possible to control (control loop dynamics) the results.

Note: It is necessary to move the drive in order to conduct the automatic control loop settings.

Prerequisites for starting the automatic control loop settings



WARNING

⇒ Check and make sure that the emergency stop travel range limit switch is working.

See section: Safety Guidelines.

⇒ During the command **D900 Command automatic loop tuning,** the drive conducts its own external command value programmed motions.

Definition of travel range for control loop settings

Since the axis must be moved in order to identify and set the control loop, it is necessary to define a travel range. There are two options:

- Define a travel range by inputting the limits, **P-0-0166, Lower position limit for autom. control loop adjust** and **P-0-0167, Upper position limit for autom. control loop adjust** (a downwardly-compatible function).
- Input **P-0-0169**, **Travel distance for autom. control loop adjust** (needed with modulo axes!)

Note: The mode is selected with the use of parameter **P-0-0165, Selection for autom. control loop adjust**.

Inputting the limits P-0-0166, P-0-0167

If bit15 of P-0-0165 has not been set, then the range in which the axis may move with an automatic control loop setting is defined with

- an upper limit position **P-0-0166**
- and a lower limit position **P-0-0167**

This results in the value of **P-0-0169, Travel distance for autom. control loop adjust.**

Inputting P-0-0169, Travel range for automatic controller settings

If **Bit15** of **P-0-0165 is set,** then the range in which the axis may move with an automatic control loop setting is defined with

- **P-0-0169, Travel distance for autom. control loop adjust** and
- **Start position** (actual position) **at the start of a command**

This results in the value of **P-0-0166,** lower limit for automatic CL (start position - travel range) and of **P-0-0167**, upper limit for automatic CL (start position + travel range) in which the axis may move to execute the command.

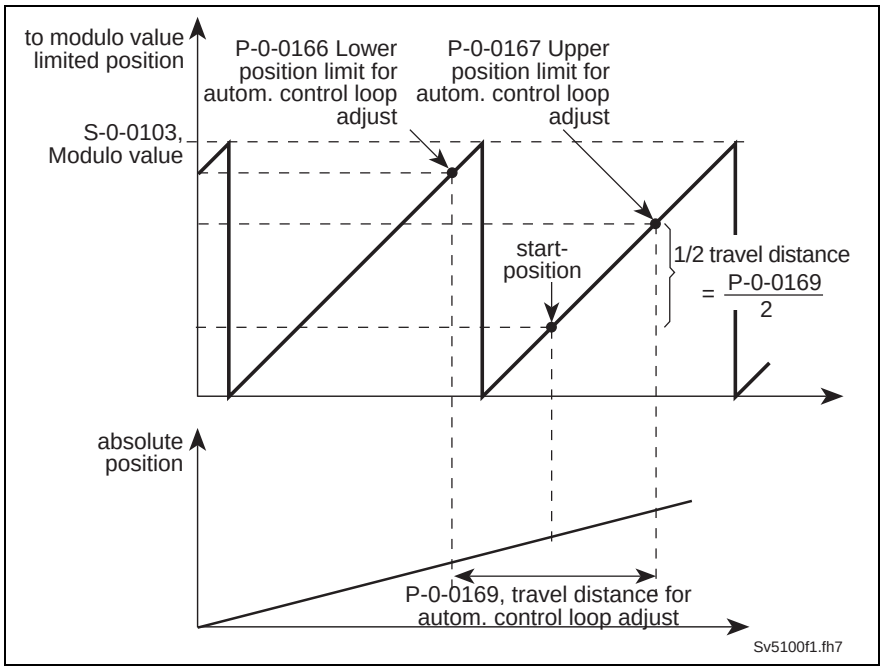

to modulo value limited position
P-0-0166 Lower position limit for autom. control loop adjust
P-0-0167 Upper position limit for autom. control loop adjust
S-0-0103, Modulo value
start-position
1/2 travel distance = P-0-0169 / 2
absolute position
P-0-0169, travel distance for autom. control loop adjust
Sv5100f1.fh7

Fig. 8-70: Verfahrbereich bei autom. Regelkreiseinstellung bei Modulowichtung

Note: The travel range defined here is only monitored during the time that the command is being executed.

Possible errors:

D905 Position range invalid, P-0-0166 & P-0-0167

If the defined travel path equals less than six motor revolutions, then command error **D905 Position range invalid, P-0-0166 & P-0-0167** will be generated.

D906 Travel range exceeded

If the axis is not within the above defined range at the start of the command, then command error **"D906 Position range exceeded"** is generated.

Control loop settings

Before executing the command, set the default control parameters stored in the motor feedback. The setting of the axis must be stable so that the command can be executed without any faults.

Drive enable or drive start

The oscillations and thus the automatic control loop settings are only conducted if

- the **drive enable** is present

  and

- **drive start** is issued.

Note: In fieldbus drives with DRIVECOM profile, this is the "Operation enable" equivalent. The status machine must still be run up!

Note: If there is no drive enable at command start, then command error D901 Start requires drive enable is generated.

Command settings

All parameters used in the execution of the command must be programmed before command start so that they are effective in the automatic control loop setting.

- **P-0-0163, Damping factor for autom. control loop adjust**
  Use this parameter to select the desire control loop dynamics.
- **P-0-0164, Application for autom. control loop adjust** helps taking the mechanical conditions with controller optimization into account.
- **P-0-0165, Selection for autom. control loop adjust**
  Used to select functinalities (modes) of the automatic control loop settings.

Possible causes for command errors:
"D903 Inertia detection failed"

- **S-0-0092, Bipolar torque/force limit value**
  The maximum torque for the automatic control loop settings can be programmed with parameter **S-0-0092, Bipolar torque/force limit value**. This can help limit the torque to prevent mechanical wear and tear.
- **S-0-0108, Feedrate override**
  The velocity of the automatic control loop settings can be programmed via the analog channel (Poti) with this parameter.
- **S-0-0259, Positioning Velocity**
  This sets the speed for the control loop settnigs. If the value is not high enough, the command error D903 is generated.
- **S-0-0260, Positioning Acceleration**
  The maximum positioning speed is set here. If the value is not high enough, then command error D903 is generated.

Note: The reasons that command error **D903 Inertia detection failed** is generated can either be an excessive inertia, a too slow speed, acceleration or torque.

Conducting Automatic Control Loop Settings

Note: 1) The execution of the settings is connected with a drive motion. This means that the drive moves in terms of the travel range fixed in parameters P-0-0166 and P-0-0167 or P-0-0169.
2) The parameter settings needed to conduct the command must be generated prior to command start.

Start command

Initiated by writing into parameter **P-0-0162, D900 Command Automatic control loop adjust** with binary numeric value 3 (11b) (=command start).

Tripping a motion

An axis motion and thus the execution of a setting is only possible if the signal **Drive halt** has not been set.

Otherwise, **D900 Command automatic loop tuning** at the appears in the display start of the command and the axis does not move.

Triggering a motion by starting command D900

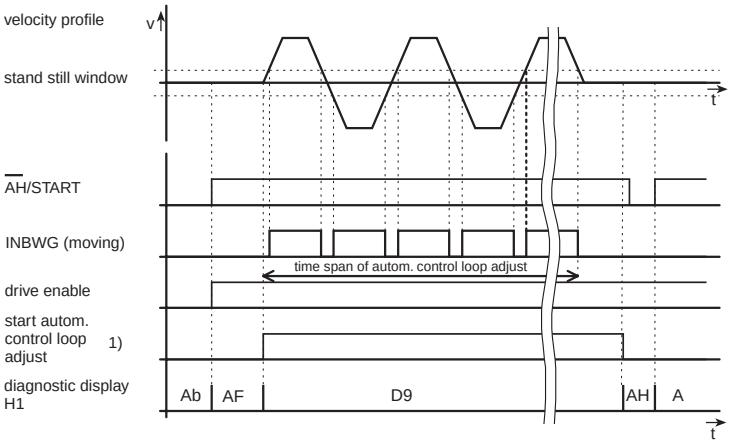


Fig. 8-71: Signal flow chart

Triggering motion with drive start

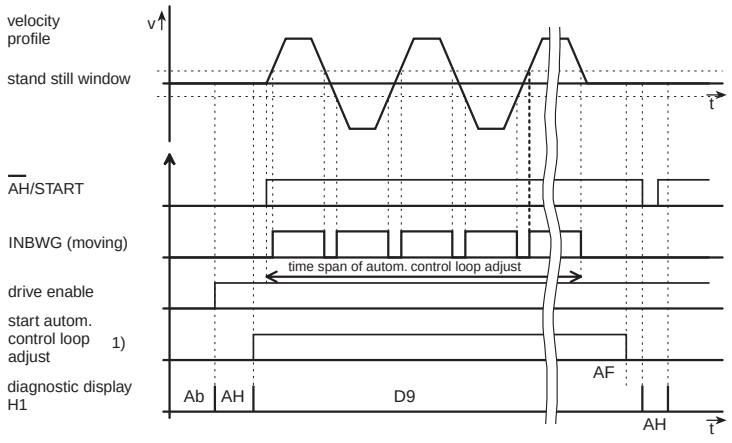


Fig. 8-72: Signal flow chart

Terminating command with drive halt

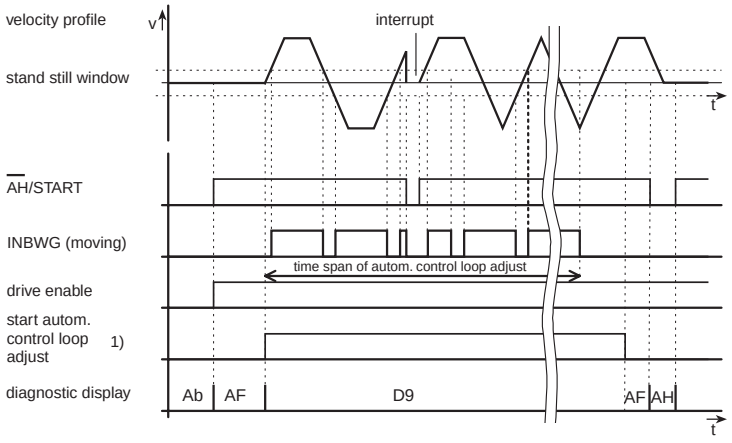


Fig. 8-73: Signal flow chart

Note:	A further run with change settings can be conducted either**:** 1) by removing and then applying the drive enable or start signal (drive start) 2) or by ending and then restarting command D900

Chronological Sequence of Automatic Control Loop Settings

Sequence:

1st step: Check for command errors at command start.

2nd step: **Determine total and extrinsic inertia** by evaluating accel and decel procedures.

3rd step: **Calculate** and use **controller parameters** in drive.

The Parameters **P-0-0163, Damping factor for autom. control loop adjust** and **P-0-0164, Application for autom. control loop adjust** will be checked.

4th step: **Check speed control loop** and correct controller parameter, if need be, until correct behavior appears (depends on dynamics programmed).

5th step: **Check position control loop** and correct controller parameters, if need be, until aperiodic behavior in control loop appears.

6th step: END Wait for **new start** or **end of command**.

This drive here is idle (velocity = 0) and the display reads D9.

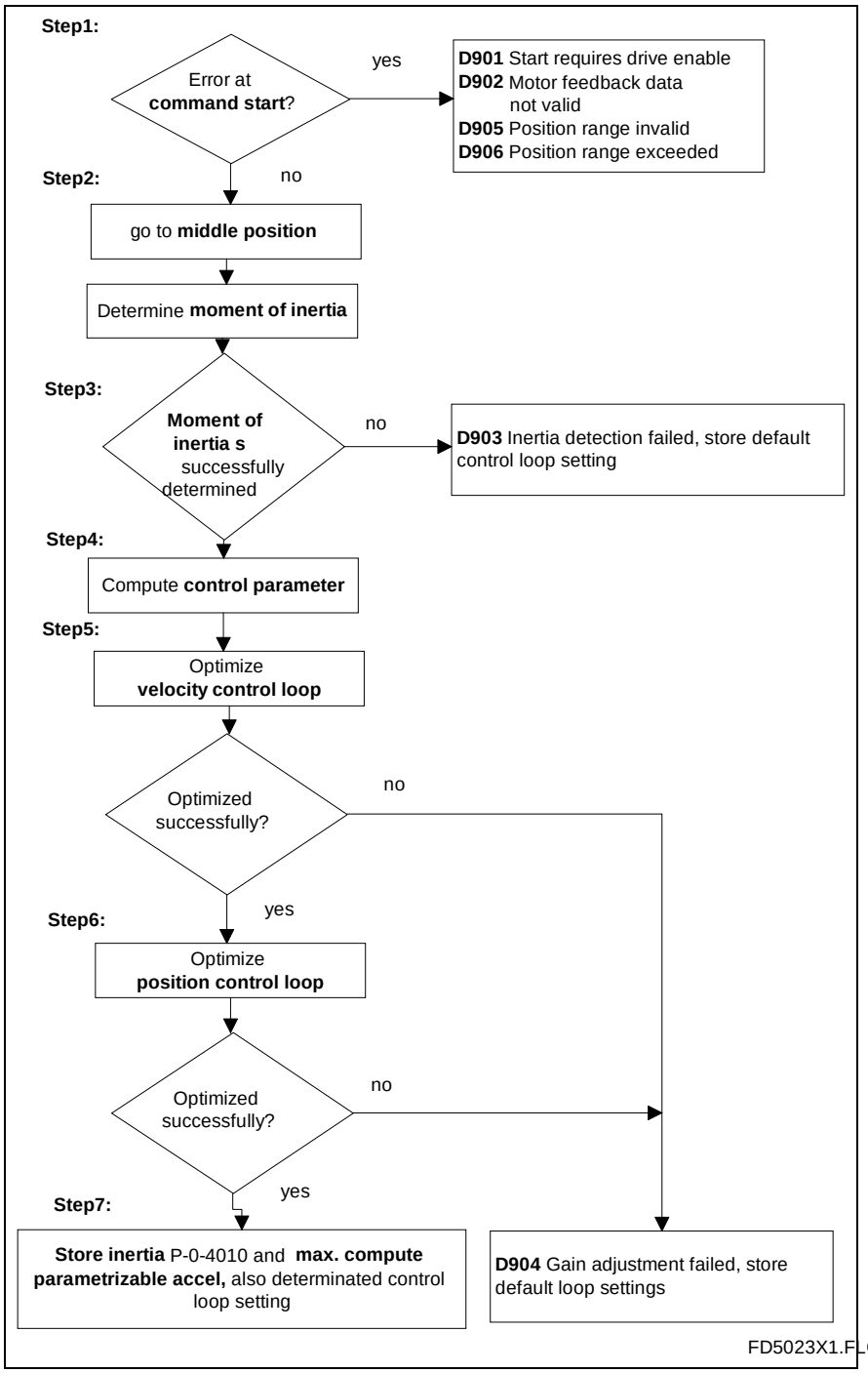


Fig. 8-74: Automatic control loop setting sequence

Results of Automatic Control Loop Settings

Note: The current control loop is not effected hereby as its setting is load-dependent and set to optimum current control parameters at the factory.

The results of automatic control loop settings depends on the selection in **P-0-0165, Selection for autom. control loop adjust**.

Parameter structure:

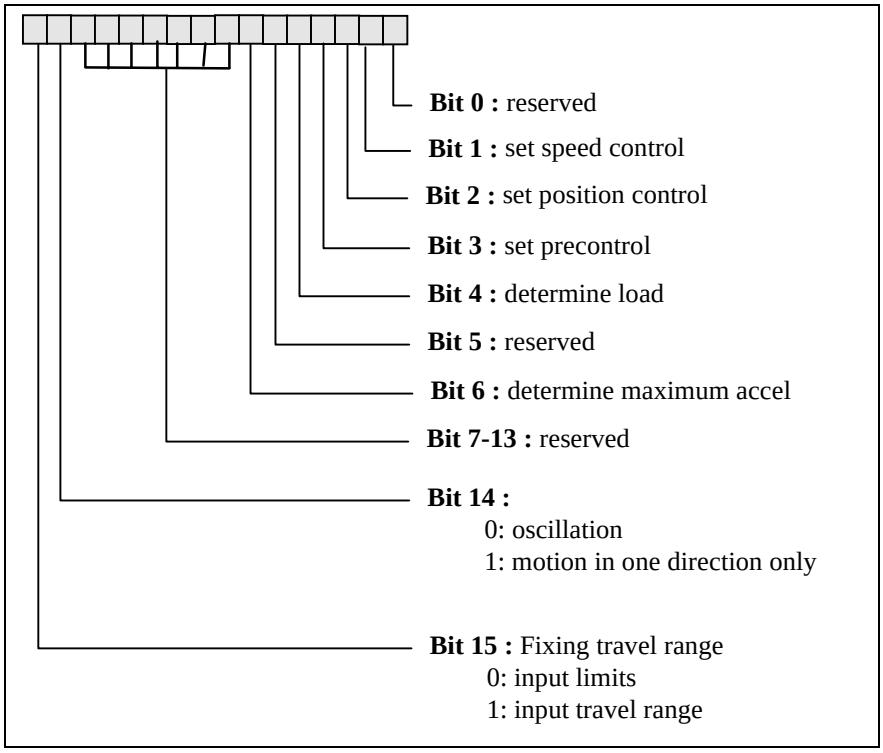

Bit 0 : reserved
Bit 1 : set speed control
Bit 2 : set position control
Bit 3 : set precontrol
Bit 4 : determine load
Bit 5 : reserved
Bit 6 : determine maximum accel
Bit 7-13 : reserved
Bit 14 :
0: oscillation
1: motion in one direction only
Bit 15 : Fixing travel range
0: input limits
1: input travel range

Fig. 8-75: Select parameter for automatic control loop settings

Possible results are:

- Set velocity control loop
- Set **positon control loop**
- **P-0-4010, Load inertia** (reduced to motor shaft)
  The load determined for automatic control loop settings is stored here.
- **P-0-0168, Maximum acceleration**
  Maximum drive acceleration for loop settings is stored here.
- **S-0-0348, Acceleration feedforward gain**
  As the results of the automatic settings, the value for accel precontrol is calculated in accordance with the formula:

  S-0-0348 = (P-0-4010 + P-0-0510) / S-0-0051.

8.8 Drive Halt

The drive halt function is used to bring an axis to a standstill with a defined accel and defined jerk.

The function is activated:

- by clearing the drive halt bit
- upon removal of bit3 in the fieldbus control word (with fieldbus interface with DRIVECOM profile)
- upon removal of **bit1 in the fieldbus control word** (with fieldbus interface with **I/O mode**)
- by setting drive halt input with parallel or analog interface to zero
- or by interrupting a drive control command (e.g., drive-guided referencing).

Pertinent Parameters

- **S-0-0138, Bipolar acceleration limit value**
- **S-0-0349, Jerk limit bipolar**
- **P-0-1201, Ramp 1 pitch**
- **P-0-1202, Final speed of ramp 1**
- **P-0-1203, Ramp 2 pitch**

The following parameters are used for diagnostic purposes:

- **S-0-0124, Standstill window**
- **S-0-0182, Manufacturer's status class 3**

The Functional Principle of Drive Halt

If the drive halt function is activated, then the drive does not follow the command values of the active mode but rather brings the drive to a halt while maintaining the parameterized accel.

The manner in which the standstill takes place depends on the previously activated operating mode.

Bringing to standstill in position control with the previously active limit accel and jerk

The standstill is in position control with the use of the previously active limit accel and limit jerk, if a mode with drive-internal position command generation was active.

Operating modes with drive-internal position command generation are:

- drive-internal interpolation
- relative drive-internal interpolation
- positioning block mode
- jog mode.

Bringing to standstill in position control with S-0-0138 and S-0-0349

Standstill takes place in position control with the use of accel in **S-0-0138, Bipolar acceleration limit value** an the jerk in **S-0-0349, Jerk limit bipolar**, if previously a position-control mode without drive-internal position command generation was active.

Operating modes without drive-internal position command generation is position control

Standstill in velocity control

If either the **velocity control or torque control modes** were previously active, then deceleration in velocity control uses parameters

- **P-0-1201, Ramp 1 pitch**
- **P-0-1202, Final speed of ramp 1**
- **P-0-1203, Ramp 2 pitch**

Note: In all cases, the SS display reads AH and the diagnosis in S-0-0095 reads A010 Drive HALT.

Drive halt acknowledgement

If the actual velocity falls below the value of the parameter **S-0-0124, Standstill window**, the bit11 "Drive Halt Confirmation" will be set in

S-0-0182, Manufacturer class 3 diagnostics.

Activating the operating mode

The selected mode becomes active once again if:

- with fieldbus interface without profile bit 13 in the fieldbus control word reset to 1.
- **Bit3 in P-0-4077, Fieldbus control word** is set again (with fieldbus interface with **DRIVECOM profile**)
- **Bit1 in P-0-4077, Fieldbus control word** is set again (with fieldbus interface with **I/O mode**)
- the drive halt input is set again (with parallel or analog interface)

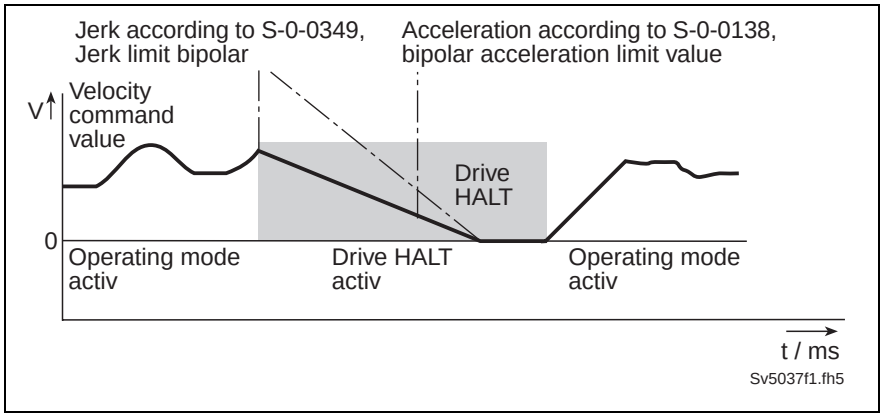


Fig. 8-76: Principle of drive halt with previously active position control without drive-internal position command value generation

Note: If an operating mode with position control with lag error was also previously activated, then the position controlled standstill is conducted with position control with lag error. Otherwise, the function is conducted without lag error.

Connecting the drive halt input

If command communication does not use a fieldbus, e.g., SERCOS interface or Profibus, then the hardware controls the drive halt function.

For more information on this see the Project Planning Manual, sec.: Drive halt and drive enable.

8.9 Drive-Controlled Homing

The position feedback value of the measuring system to be referenced forms a coordinate system referencing the machine axis. This system does not comply with the machine coordinate system after the drive has been initialized, as long as no absolute encoders are used.

Command **S-0-0148, C600 Drive controlled homing procedure command** thus supports

- in non-absolute measuring systems, establishing agreement between drive (measuring system) and the machine coordinate system;
- in absolute measuring systems, the drive-controlled running to the reference point

Drive-controlled homing means that the drive independently creates the necessary motion, which corresponds to the homing velocity settings and homing acceleration settings.

Note: This feature can be executed for either the motor encoder or the optional encoder.

Pertinent Parameter

To run this feature, use the following parameters:

- **S-0-0148, C600 Drive controlled homing procedure command**
- **S-0-0147, Homing parameter**
- **S-0-0298, Reference cam shift**
- **S-0-0299, Home switch offset**
- **S-0-0052, Reference distance 1**
- **S-0-0054, Reference distance 2**
- **S-0-0150, Reference offset 1**
- **S-0-0151, Reference offset 2**
- **S-0-0041, Homing velocity**
- **S-0-0042, Homing acceleration**
- **P-0-0153, Optimal distance home switch - reference mark**
- **S-0-0177, Absolute distance 1**
- **S-0-0178, Absolute distance 2**
- **S-0-0165, Distance coded reference offset 1**
- **S-0-0166, Distance coded reference offset 2**

The following parameters

- **S-0-0108, Feedrate override**
- **S-0-0057, Position window**
- **S-0-0349, Jerk limit bipolar**
- **S-0-0403, Position feedback value status**

also can be used.

Setting the referencing parameters

The basic sequence is dependent on how parameter **S-0-0147, Homing parameter** has been parametrized.

The following settings are performed:

- referencing direction positive/negative
- referencing with motor or optional encoder
- evaluation of the home switch yes/no
- evauation of the marker yes/no
- go to reference point yes/no

The parameter is structured as follows:

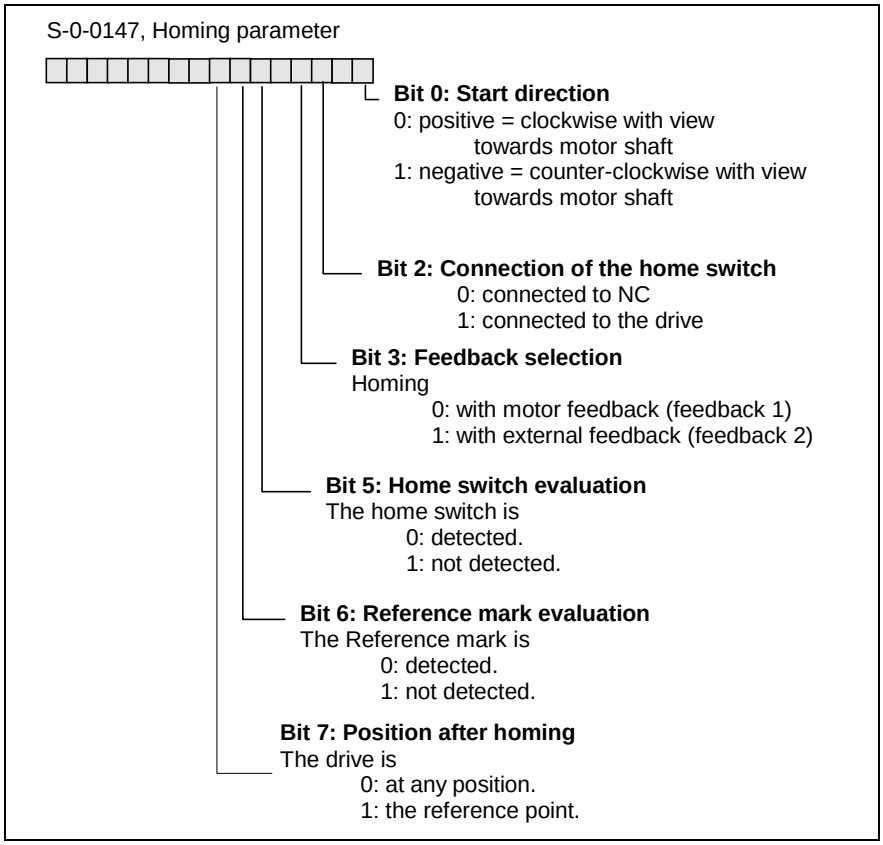

S-0-0147, Homing parameter
Bit 0: Start direction
0: positive = clockwise with view towards motor shaft
1: negative = counter-clockwise with view towards motor shaft
Bit 2: Connection of the home switch
0: connected to NC
1: connected to the drive
Bit 3: Feedback selection
Homing
0: with motor feedback (feedback 1)
1: with external feedback (feedback 2)
Bit 5: Home switch evaluation
The home switch is
0: detected.
1: not detected.
Bit 6: Reference mark evaluation
The Reference mark is
0: detected.
1: not detected.
Bit 7: Position after homing
The drive is
0: at any position.
1: the reference point.

Fig. 8-77: Structure of parameter S-0-0147, Homing parameter

Hinweis: The sequence also depends on the type and arrangement of the reference markers in terms of the referenced encoder.

Overview of the Type and Allocation of Reference Marks of Non-Absolute Measuring Systems

For better a understanding, you can divide the measurement systems into 4 groups according to the type and configuration of their reference marks.

- **Type 1**: Measurement systems with absolute singleturn range, such as the Singleturn DSF or Resolver. These measurement systems have an absolute range of one encoder revolution or fractions of it (resolver). Typical systems are the encoders for the MHD, MKD and MKE motors and the GDS measurement system.
- **Type 2**: Incremental rotational measurement systems with a reference mark for each encoder rotation, such as the ROD or RON types from the Heidenhain Company.
- **Type 3**: Incremental translation measurement systems with one or several reference marks, such as the LS linear scaling of the Heidenhain Company.

- **Type 4**: Incremental measurement systems with distance coded reference marks, such as the LSxxxC linear scaling of the Heidenhain Company.

The drive-internal detection for the configuration of the reference marks is done with the settings of the corresponding position encoder type parameter **S-0-0277, Position feedback 1 type** (for motor encoder) or **S-0-0115, Position feedback 2 type** (for optional encoder).

In these parameters, you set with **bit 0** whether it's a rotary or a linear measurement system, and **bit 1** decides whether the measurement system has distance-coded reference markers.

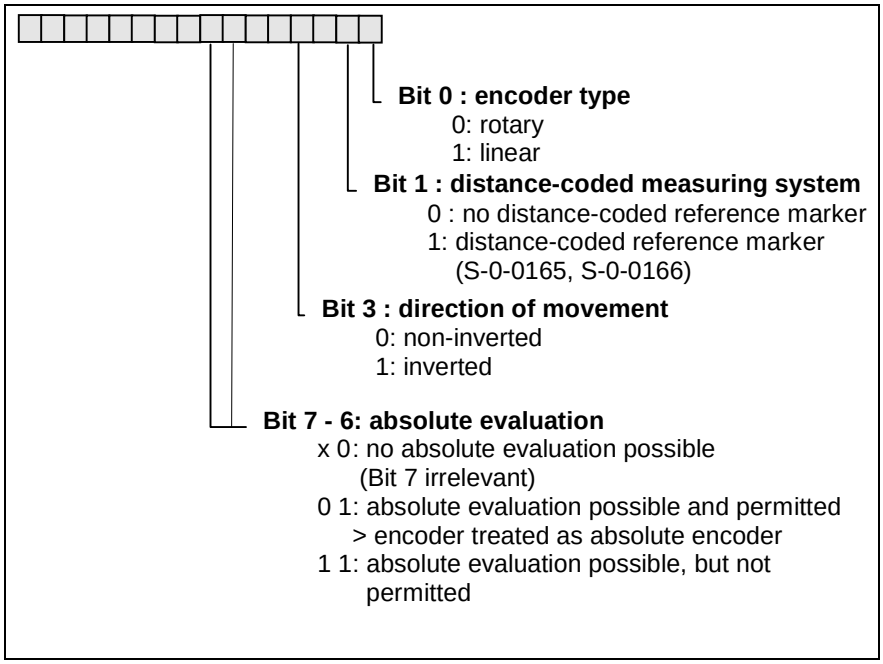

Bit 0 : encoder type
0: rotary
1: linear
Bit 1 : distance-coded measuring system
0 : no distance-coded reference marker
1: distance-coded reference marker
(S-0-0165, S-0-0166)
Bit 3 : direction of movement
0: non-inverted
1: inverted
Bit 7 - 6: absolute evaluation
x 0: no absolute evaluation possible
(Bit 7 irrelevant)
0 1: absolute evaluation possible and permitted
> encoder treated as absolute encoder
1 1: absolute evaluation possible, but not
permitted

Fig. 8-78: Structure of the position feedback type parameters S-0-0115 / S-0-0277

Note: For measurement systems with their own data memory (Type 1), this setting is done automatically.

See also chapter: "Setting the Measurement System".

Functional Principle of Drive-Controlled Referencing in Non-Absolute Measuring Systems

To establish congruency between drive (measuring system) and machine coordinate system it is necessary that the drive has precise information about its relative position within the machine coordinate system. The drive receives this information by detecting the home switch edge and/or the reference mark.

Note: To evaluate only the home switch is not recommended as the position of the home switch edge has a lesser precision compared to the detection of the reference mark!

Coordinate system compensation is achieved by comparing the desired feedback position at a specific point within the machine coordinate system with the actual feedback position ("old" drive coordinate system). A differentiation in this case is made between "Evaluation of a reference mark/home switch edge" (type 1 .. 3) and "Evaluation of distance-coded reference marks".

- With "**Evaluation of a reference mark/home switch edge**" the "specific" point within the coordinate system is the so-called reference point. The desired feedback position is set at this point via parameter **S-0-0052, Reference distance 1** (for motor encoders) or **S-0-0054, Reference distance 2** (for optional encoders). The physical position of the reference point derives from the position of the reference marker plus the value in **S-0-0150, Reference offset 1** or **S-0-0151, Reference offset 2**. Once the reference marker is detected, the drive knows the position of this marker and therefore also that of the reference point in the "old" drive coordinate system. The desired position is in parameter S-0-0052/ S-0-0054.
- With "**Evaluation of distance-coded reference marks**" the "specific" point is the zero point (position of the first reference mark) of the distance-coded measuring system. By detecting the position difference between two adjacent reference marks the position of the first reference marker in the "old" drive coordinate system can be determined. The desired feedback position at this point is defined by the position of the first reference mark in the machine coordinate system at this point plus the value in **S-0-0177, Absolute distance 1** (for motor encoders) or **S-0-0178, Absolute distance 2** (for optional encoders).

In both cases, the difference between both coordinate systems is added to the "old" drive coordinate system. The coordinate systems will then comply.

By switching the position command and feedback value, **S-0-0403, Position feedback value status** is set to 1. This means that the feedback position value now refers to the machine zero point.

Note: If the drive, once the reference command has been conducted, is in parameter mode again, then parameter S-0-0403, Position feedback value status is set to 0, because the feedback values in command **S-0-0128, C200 Communication phase 4 transition check** are re-initialized.

Functional Principle of Drive-Guided Referencing with Absolute Measuring Systems

If the referenced measuring systems (per bit 3 of S-0-0147) is to be evaluated as an absolute measuring system, i.e., in the relevant encoder type parameter (S-0-0277/S-0-0115) bit 6 is at "1“ and bit 7 on "0“, then command **S-0-0148, C600 Drive controlled homing procedure command** supports two different purposes**:**

- drive-guided traveling to the reference point
- resolution of the actual position value if absolute measurement is conducted with drive enable applied.

Drive-guided traveling to reference point

If the absolute encoder is referenced, i.e., parameter **S-0-0403, Position feedback value status** is set to "1", then the drive, after start of command **S-0-0148, C600 Drive controlled homing procedure command** itself runs to the reference point if "1" is set in bit 7 of parameter **S-0-0147, Homing parameter** for "Drive on reference point after drive-guided referencing". The reference point is defined in parameters **S-0-0052, Reference distance 1** or **S-0-0054, Reference distance 2**.

Triggering actual position value switch with absolute dimension set

If command **P-0-0012, C300 Command 'Set absolute measurement'** is conducted with drive enable applied, then the actual switching by the drive of the actual position value register (S-0-0051, **Position feedback 1 value** or S-0-0053, **Position feedback 2 value**) is not conducted until

- command **S-0-0148, C600 Drive controlled homing procedure command** is also conducted after the start of P-0-0012 or
- drive enable is switched off.

(See section: "Set absolute dimension“)

Sequence control "Drive-Controlled Homing"

The command profile depends on the parameters

- **S-0-0041, Homing velocity,**
- **S-0-0108, Feedrate override and**
- **S-0-0042, Homing acceleration.**

To limit the acceleration changes, you can additionally activate a jerk limit. You can do this by entering the parameter **S-0-0349, Jerk limit bipolar**.

The following diagram explains this:

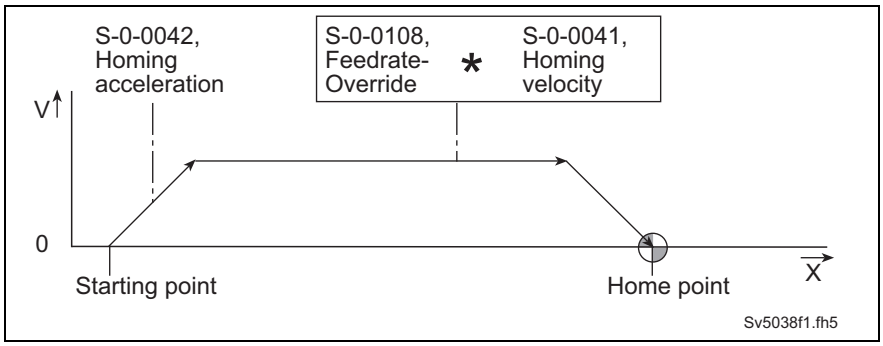


Fig. 8-79: Position command profile with homing velocity and homing acceleration

maximum velocity

The maximum velocity is influenced, like with all drive-controlled functions, by the feedrate. The effective maximum velocity is the result of the product of **S-0-0041, Homing velocity** and **S-0-0108, Feedrate override**.

Note: The maximum velocity is influenced, like with all drive-controlled functions, by the feedrate. The effective maximum velocity is the result of the product of **S-0-0041, Homing velocity** and **S-0-0108, Feedrate override.**

motional process

The motional process during drive-controlled homing of non-absolute encoders can be made up of up to three processes:

- If the home switch evaluation process has been activated and there are no distance-coded reference markers, then the drive accelerates to the homing velocity in the selected homing direction until the positive home switch edge is detected. If the drive is already on the home switch at the start of drive-controlled referencing (**S-0-0400, Home switch** = 1), the drive at first accelerates in the opposite direction until the negative home switch edge is detected, and then reverses the direction.

WARNING

⇒ Make sure that the home switch edge is within the reachable travel range.

- If reference markers are available (type 2 to 4, see above), and if the reference marker evaluation is activated, then the drive runs in homing direction until it detects a reference marker. In distance-coded measuring systems (type 4), two sequential reference markers must be passed. The reference markers are always evaluated there (independent of bit 6 in S-0-0147).

S-0-0147, Bit 7 = 0

- The further action depends on how bit 7 has been set in **S-0-0147, Homing parameter**. If bit 7 = 0 is programmed ("any position after homing"), then the drive brakes with the programmed homing acceleration up to standstill. If the value of the velocity feedback is less than the value set in **S-0-0124, Standstill window**, then the coordinate system of the referenced encoder is set, and the command is signalled as completed.

S-0-0147, Bit 7 = 1

- If a 1 is set in bit 7, ("Drive travels to reference point"), then the drive positions to the reference point. The reference point in encoders of the types 1 to 3 is defined by the position of the reference mark plus the relevant reference offset (S-0-0150 / S-0-0151). In the case of distance-coded reference markers, the drive runs to the second detected mark. The coordinate system switch and the completion message of the command are generated as soon as the drive-internal position command has reached the target value and the difference between feedback and target value is less than the value set in **S-0-0057, Position window.**

The following illustrates the sequence for "Drive goes to reference point"

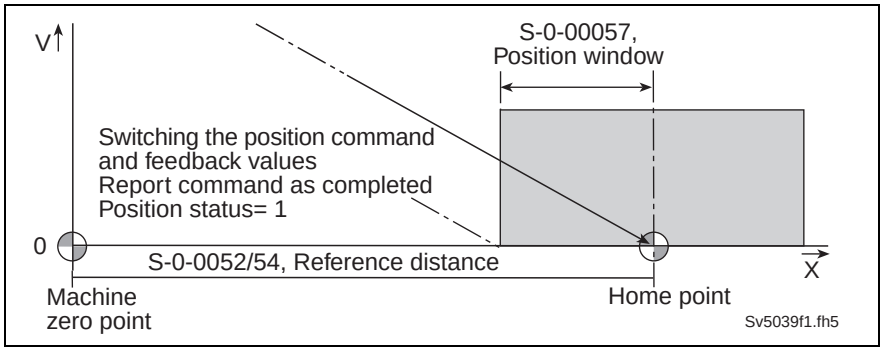


Fig. 8-80: Switching of position command and actual feedback values

Actual Feedback Values After the "Drive-Controlled Homing" Command

The position feedback values from the motor and optional encoders, after the drive-controlled homing command is processed, depend on bit 3 in **S-0-0147, Homing parameter** and on the availability of an absolute encoder as a motor or optional encoder.

Motor encoder:	Ext. encoder:	S-0-0147 Bit 3:	Actual feedback value 1:	Actual feedback value 2:
absolute	not absolute	1	unchanged	reference distance 2
not absolute	absolute	0	reference distance 1	unchanged
not absolute	not absolute	0	reference distance 1	reference distance 1
not absolute	not absolute	1	reference distance 2	reference distance 2

Fig. 8-81: Position feedback values after the drive-controlled homing command

Commissioning with "Evaluation of reference marker/home switch edge"

If the encoder does not have distance-coded reference marks (type 1 to 3), then select in **S-0-0147, Homing parameter** whether

- home switch evaluation is desired or not and/or
- reference mark evaluation is desired.

Additionally must be defined,

- in which direction the drive should move with the start of the command "Drive-controlled homing" as well as whether
- the drive should go to the reference point or not.

If a home switch evaluation becomes necessary, then the necessary settings must first be made (see "Evaluation of the Home Switch"). All additional steps can then be conducted as follows:

⇒ Check the relevant position encoder type parameter (S-0-0277 / S-0-0115) to make sure it has been correctly set.

⇒ Parametrize the following parameter with 0

- **S-0-0052, Reference distance 1 or**
- **S-0-0054, Reference distance 2**
- **S-0-0150, Reference offset 1 or**
- **S-0-0151, Reference offset 2.**

⇒ Set parameters **S-0-0041, Homing velocity** and **S-0-0042, Homing acceleration** to small values (e.g., S-0-0041 = 10 Rpm, S-0-0042 = 10 rad/s².

⇒ Conduct the drive-controlled homing command.

Note: If the command is cleared, then the original operating mode becomes active. If drive-internal interpolation is set, then the drive immediately runs to the value set in **S-0-0258, Target position.** This value relates to the new (machine zero point) coordinate system!

Result of the Drive-Controlled Homing-Command

The command should be completed without error. The machine zero point is at the position of the home switch or the referencing point as the reference distances (S-0-0052/54) have been parametrized with 0. The position feedback value in **S-0-0051, Position feedback 1 value** or **S-0-0053, Position feedback 2 value** should now have absolute reference to this preliminary machine zero point.

To set the correct machine zero point, you can now conduct the following steps:

⇒ Run the axis to the desired machine zero point and set the feedback position value displayed there with opposite sign in **S-0-0052, Reference distance 1** or **S-0-0054, Reference distance 2.**

or:

⇒ Run the axis to position feedback value = 0, measure the distance between the current position and the desired machine zero point. Enter the distance in **S-0-0052, Reference distance 1** or **S-0-0054, Reference distance 2.**

Once the drive-controlled reference command is again completed, the position feedback value should refer to the desired machine zero point.

The reference point can be shifted relatively to the reference mark (see "Consideration of the reference offset").

Parameter **S-0-0041, Homing velocity** and **S-0-0042, Homing acceleration** can now be set to their final values.

Consideration of the Reference Offset

If the evaluation of the reference mark is activated in the homing parameter, then the reference point is always set on the position of the selected reference mark. If a measurement system of type 1..3 is present (not distance-coded), you can shift the position of the reference point relatively to the reference marker. Doing so, you can select any position after homing.

The offset is set with the parameters

- **Reference Offset 1** (for motor encoder)
- **Reference Offset 2** (for optional encoder)

positiv reference offset

If the **reference offset is positive**, then its drive-internal direction is positive (see "Command Polarities and Actual Value Polarities"). In other words, the reference point is moved in terms of the reference mark in a clockwise direction when looking towards the motor shaft. If the homing direction is also positive, then the drive does not reverse the direction after passing the reference marker.

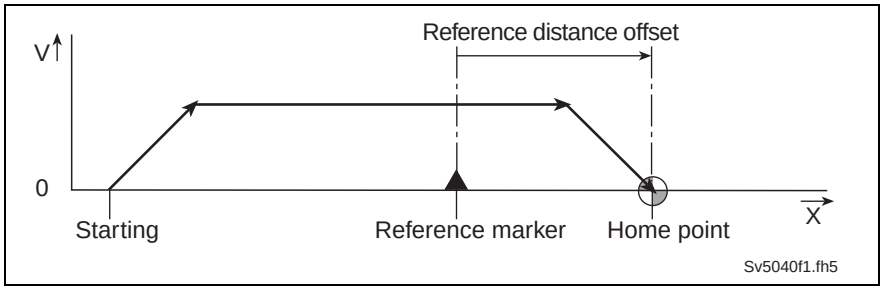


Fig. 8-82: Command value profile for positive reference offset and positive homing direction

If the **reference direction is negative**, then the drive must reverse the direction (with types 2 and 3) after passing the reference marker.

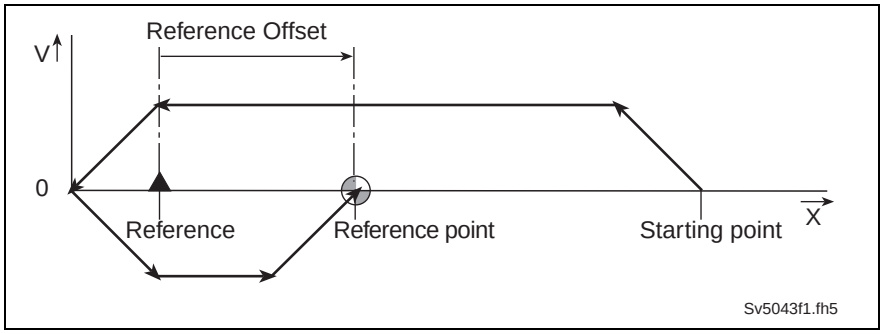


Fig. 8-83: Command profile for positive reference offset and negative homing direction

negative reference offset

If the **reference offset is negative**, then its drive-internal direction is negative (see chapter: "Command Polarities and Actual Value Polarities"). In other words, the reference point is shifted counterclockwise looking towards the motor shaft. If the reference direction is negative, then the drive does not reverse the travel direction once it has passed the reference marker.

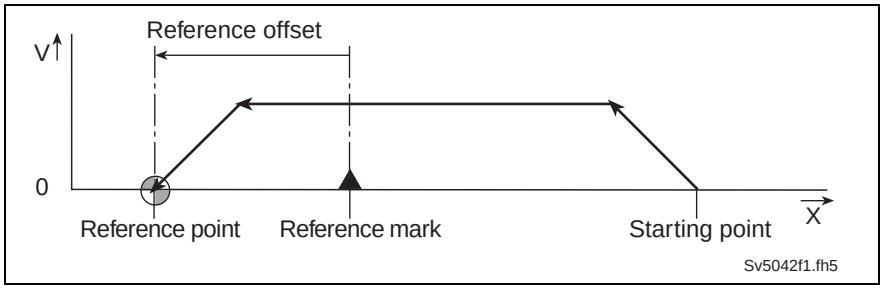


Fig. 8-84: Command profile with negative reference offset and negative homing direction

If the referencing direction is positive, then the drive must reverse the travel direction (with types 2 and 3) after passing the reference marker.

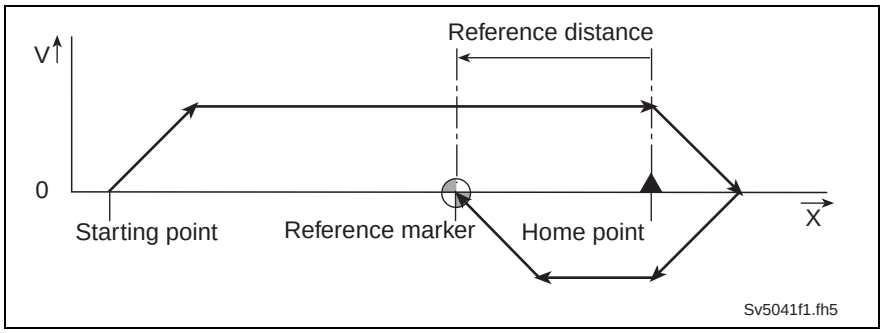


Fig. 8-85: Command profile with negative reference offset and positive homing direction

Evaluation of the Home Switch

Home switch evaluation

A home switch can label a specific marker, if the configuration of several reference marks for the homing is ambiguous. If bit 5 in S-0-0147 = 0, then that reference mark will be evaluated, which follows the positive edge of the home switch (if the drive is moving towards the homing point).

Note: The home switch input is pictured in parameter **S-0-0400, Home switch.**

Example: Homing of a motor encoder with 1 reference mark per revolution

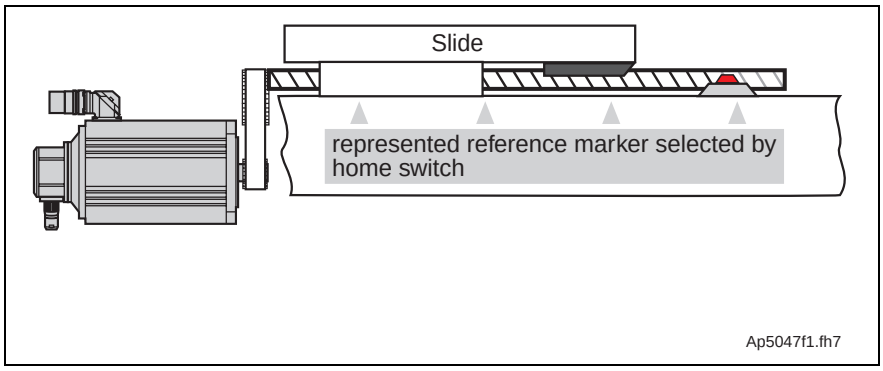


Fig. 8-86: Selection of a reference mark depending on the homing direction

If **home switch evaluation is activated**, the drive searches at first for the positive edge of the home switch. If the home switch is not actuated at the beginning of the command, the drive moves in the preset homing direction.

Note: The homing direction must be set so that the positive edge can be found.

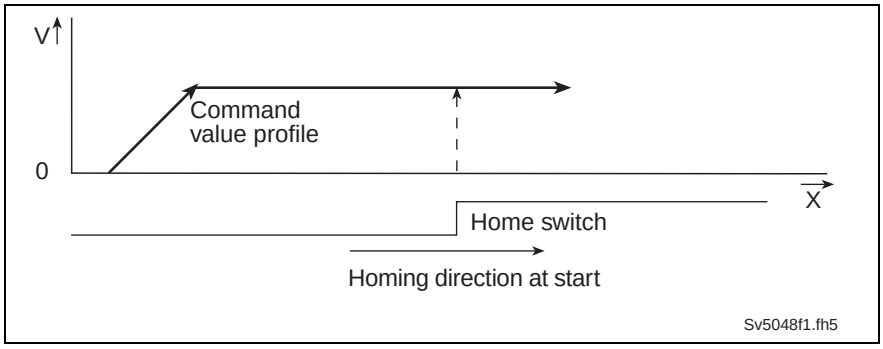


Fig. 8-87: Correct setting of homing direction

WARNING

If the homing direction setting is incorrect, the drive command value moves away from the positive home switch edge. In this case the danger exists that the drive reaches the travel range limits. This may result in damage to the system!

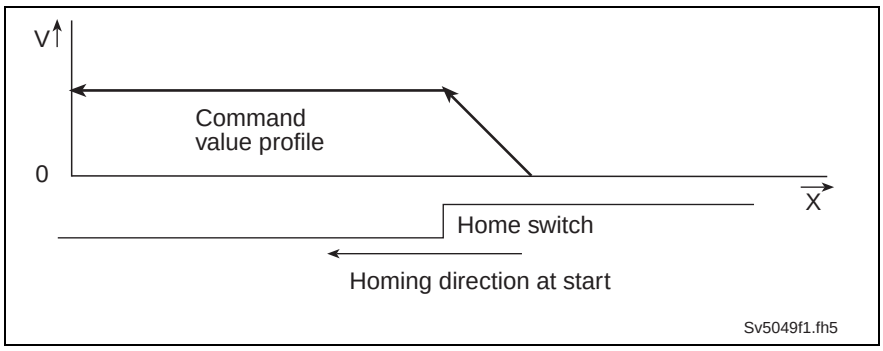


Fig. 8-88: Incorrectly set homing direction

Command value profile with actuated home switch at the start of the command

If the home switch is actuated already when the command is started, the drive generates command values in the opposite direction to move away from the home switch. As soon as a 1-0 edge from the home switch is detected, the drive reverses its direction and continues as if started outside the home switch range.

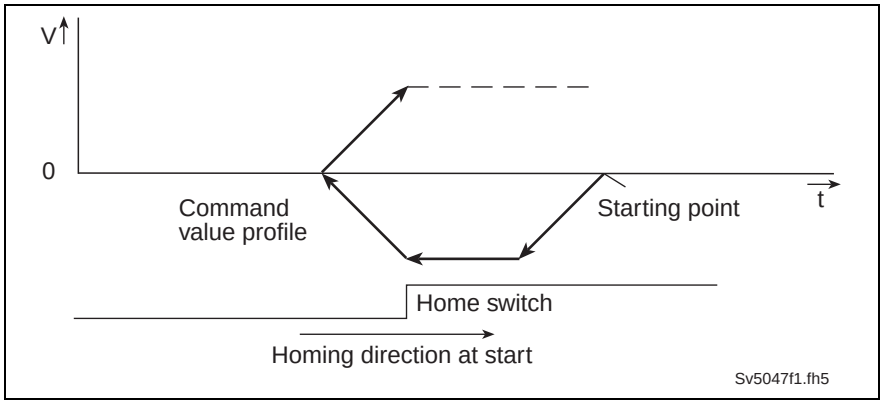


Fig. 8-89: Command profile with start position on the home switch

Monitoring the Distance Between Home switch and Homing Mark

If the distance becomes too small between the home switch edge and the reference mark, then it is possible that the home switch edge will only be detected after the reference mark has already passed. This leads to a detection of the following reference mark, and the reference mark detection becomes ambiguous.

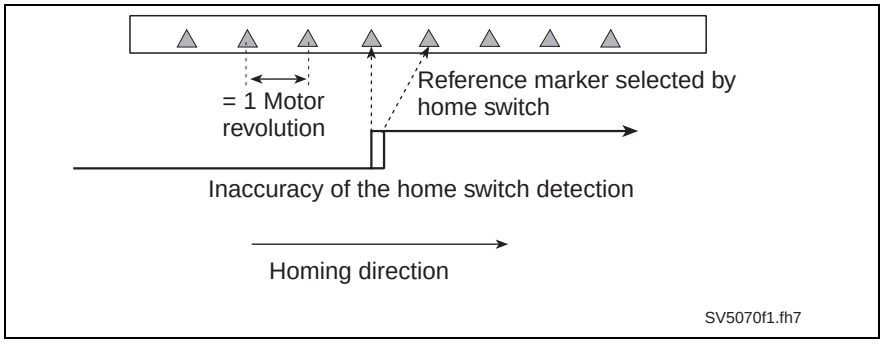


Fig. 8-90: Ambiguous detection of reference markers at small distances between home switch edge and reference mark

The distance between the home switch edge and the reference mark is monitored for this reason.

If the distance between the home switch edge and the reference mark becomes smaller than a certain value, the command error **C602 Distance home switch - reference mark erroneous** will be generated.

The Critical Range for the distance is:

0.25 • Distance between reference markers

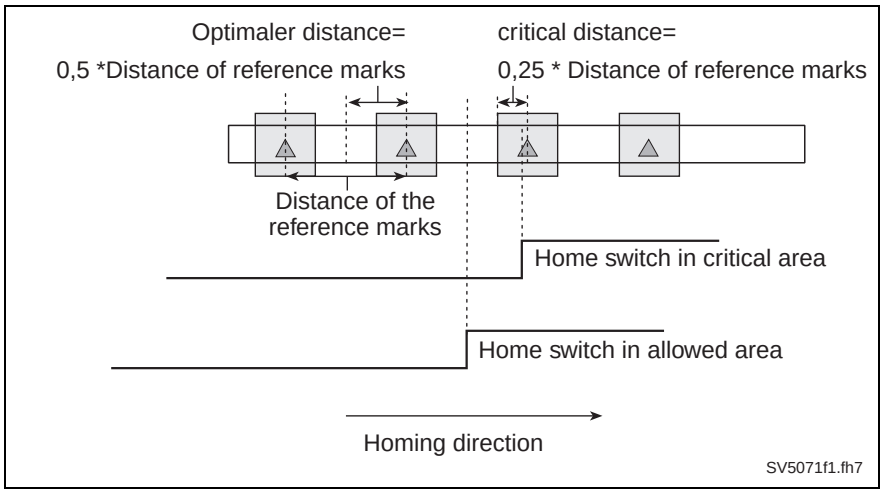


Fig. 8-91: Critical and optimal distance between home switch and reference mark

The optimal distance between the home switch edge and the reference marker is:

0.5 • Distance between reference markers

To monitor the distance between the home switch and the reference mark, the optimal distance is entered in **P-0-0153, Optimal distance home switch - reference mark**.

The following requirements apply:

Encoder type	P-0-0153	Function
Rotary	0	The distance home switch - reference mark will be monitored. The optimal spacing will be calculated internally and amounts to a 1/2 encoder rotation for DSF or incrementally rotational encoders, or 1/2 encoder revolution / **S-0-0116, Feedback 1 Resolution** for resolvers.
Rotary	x	The distance home switch - reference mark will be monitored. Half the reference mark spacing must be entered in **P-0-0153, Optimal distance home switch - reference mark**.
Linear	0	The distance home switch - reference mark will not be monitored. The linear scale does not affect reference marks with consistent intervals. The real distance between the home switch and the reference mark must be big enough to achieve a sure recognition of the home switch edge when considering the maximum homing velocity and the cycle time for the home switch input polling.
Linear	x	The distance home switch - reference mark will be monitored. Half the reference mark spacing must be entered in **P-0-0153, Optimal distance home switch - reference mark**.

Fig. 8-92: Monitoring the distance Home switch-Reference Mark

For every homing with home switch evaluation, the difference between actual distance and optimal distance is monitored. The difference is saved in parameter **S-0-0298, Reference cam shift**. The home switch edge can be shifted mechanically for this value.

To avoid a mechanical shifting of the home switch edge, you can set this procedure in the software with the parameter **S-0-0299, Home switch**

offset. The value in parameter **S-0-0298, Reference cam shift** is transferred to parameter **S-0-0299, Home switch offset**.

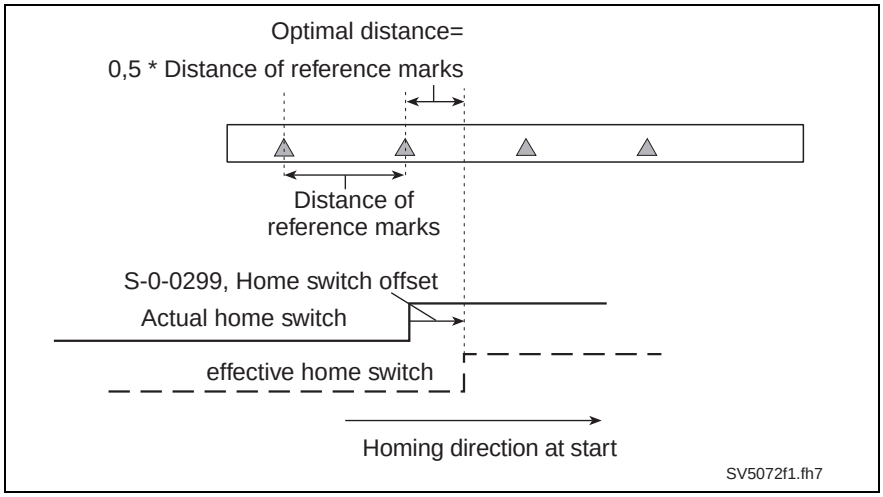


Fig. 8-93: Operation of parameter S-0-0299, Home Switch Offset

The parameter **S-0-0299, Home switch offset** can be set as follows:

- Running the homing command with **S-0-0299, Home switch offset** = 0.
- If the distance is not in the range between 0.5..1.5 * **P-0-0153, Optimal distance home switch - reference mark,** the error message **C602 Distance home switch - reference mark erroneous** will be generated. In this case, you have to enter the value **S-0-0298, Reference cam shift** into **S-0-0299, Home switch offset**.
- Check: You should see a 0 displayed in **S-0-0298, Reference cam shift** when homing is restarted.

Commissioning with "Evaluation of distance-coded reference marker"

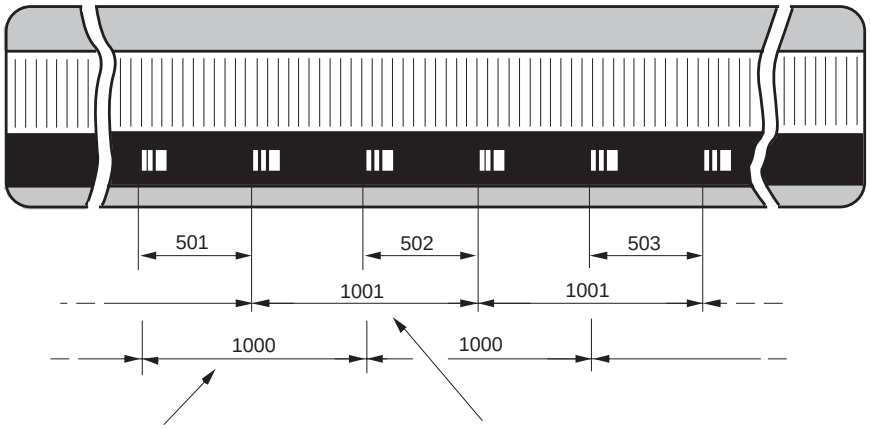
If the encoder has distance-coded reference markers (type 4), then set in **S-0-0147, Homing parameter**

- whether the home switch should be evaluated and/or
- in which direction the drive should move at the start of the command "Drive-controlled homing" ,
- whether the drive should to move to the second passed reference mark or not.

In the parameters

- **S-0-0165, Distance coded reference offset 1** and
- **S-0-0166, Distance coded reference offset 2**

the greater and smaller distance of the reference mark must be entered. These values can be retrieved from the encoder specification.



„Distance-coded reference dimension 2“ (smaller value) SERCOS-ID No.:S-0-0166; Input unit: pitch

The manufacturer of the length measuring system indicates:
distance travelled up to the absolute position value: 20 mm
pitch unit: 20 µm (0-02 mm)

20 mm: 0.02 mm = 1000 pitch units

This value (1000 pitch units) is to be entered in parameter ID No. S-0-0166.

„Distance-coded reference dimension 1“ (larger value) SERCOS ID No. S-0-0165. Input unit: pitch unit

For Heidenhein length measuring system the larger value is the product of:
(distance travelled + pitch unit):
pitch unit, therefore:
20.02 mm: 0.02 mm = 1001 pitch units

This value (1001 pitch units) is to be entered in parameter ID No. S-0-0165.

Setting up of distance-coded Heidenhain length measuring systems (taken from: Catalog for NC length measuring systems, September 1993):

Length measuring system Type	Distance travelled: in mm	Pitch unit: in µm	Input in: ID No.: S-0-0166	Input in: ID No.: S-0-0165
LS 403C LS 406C LS 323C LS 623C LS 106C ULS 300C	20	20	1000	1001
LS 103C LS 405C ULS 300C	10	10	1000	1001
LID 311C LID351C	20	10	2000	2001

Pi5005f1.fh5

Fig. 8-94: Distance-coded measuring system specified with greater and smaller distance

In **S-0-0165, Distance coded reference offset 1** the greater distance is entered, in **S-0-0166, Distance coded reference offset 2** the smaller distance. The unit of these two parameters is (division) periods. Typical vaues for a linear scale with distance-coded reference marks are 20.02 mm for the greater distance and 20.00 mm for the smaller distances with a resolution of 0.02mm. In parameter S-0-0165/166 enter the value 1001 or 1000.

The further steps are outlined below.

⇒Check the relevant position encoder type parameter (S-0-0277/S-0-0115) to the correct setting.

⇒The parameters **S-0-0177, Absolute distance 1** or **S-0-0178, Absolute distance 2** must be parametrized with 0.

⇒The parameters **S-0-0041, Homing velocity** and **S-0-0042, Homing acceleration** must be set to smaller values (e.g., S-0-0041 = 10 rpm, S-0-0042 = 10 rad/s².

⇒Execute command drive-controlled reference

Note: If the command is cleared, then the original operating mode becomes active again. If drive-internal interpolation is set, then the drive immediately goes to the value set in **S-0-0258, Target position.** This value relates to the new (machine zero point related) coordinate system!

Result ot the Drive-Controlled-Home Command

The command should be completed without error. The machine zero point is at the position of the first reference mark of the distance-coded measuring system as the absolute offset (S-0-0177/0178) was parametrized with 0. The relevant position feedback value in **S-0-0051, Position feedback 1 value** or **S-0-0053, Position feedback 2 value** should now have the absolute reference to this preliminary machine zero point.

To set the correct machine zero point, the following steps can be conducted:

⇒ Move the axis to the desired machine zero point and enter the position feedback value displayed there with the opposite qualifying sign in **S-0-0177, Absolute distance 1** or **S-0-0178, Absolute distance 2.**

Or:

⇒ Run the axis to position feedback value = 0 and measure the distance between the current position and the desired machine zero point. Enter the distance in **S-0-0177, Absolute distance 1** or **S-0-0178, Absolute distance 2.**

Once the drive-controlled reference command is again completed, the position feedback value should refer to the desired machine zero point.

Parameters **S-0-0041, Homing velocity** and **S-0-0042, Homing acceleration** can now be set to their final values.

Home switch Evaluation with Distance coded Reference Markers

To evaluate a home switch together with homing of a distance coded measuring system is only for one purpose: staying within the allowed travel range.

Higher security with a home switch

If the home switch is not evaluated, the drive always covers with the selected homing direction the distance which is necessary to capture 2 adjacent marker positions. This distance is

$$s_{Ref\,max} = (S\text{-}0\text{-}0165 * S\text{-}0\text{-}0116 / 7) + \frac{v^2}{2 \times a}$$

S-0-0165: Distance coded reference offset 1 S-0-0165, Distance coded reference offset 1
v : value in S-0-0041, Homing velocity
a : value in S-0-0042, Homing acceleration
$s_{Ref\,max}$: maximum travel distance for homing with distance coded reference markers
S-0-0116: Feedback 1 Resolution
S-0-0117: Feedback 2 Resolution

Fig. 8-95: Travel distance for homing with distance coded reference markers

If the drive is closer to the travel limit in homing direction than the necessary travel distance S_{Refmax}, it can leave the allowed travel range and do mechanical damage to the machine. To avoid this,

- make sure that the distance of the axis to the travel limit at start of the command **S-0-0148, C600 Drive controlled homing procedure command** is greater than the max. necessary travel distance S_{Refmax}, or
- evaluate the home switch.

home switch evaluation

If the home switch is evaluated, the drive automatically starts in the opposite homing direction, if at command start the home switch is actuated (**S-0-0400, Home switch** = 1).

Therefore, the home switch must be mounted in such a way that it covers at least the max. necessary travel distance S_{Refmax} until reaching the travel range limit in the homing direction.

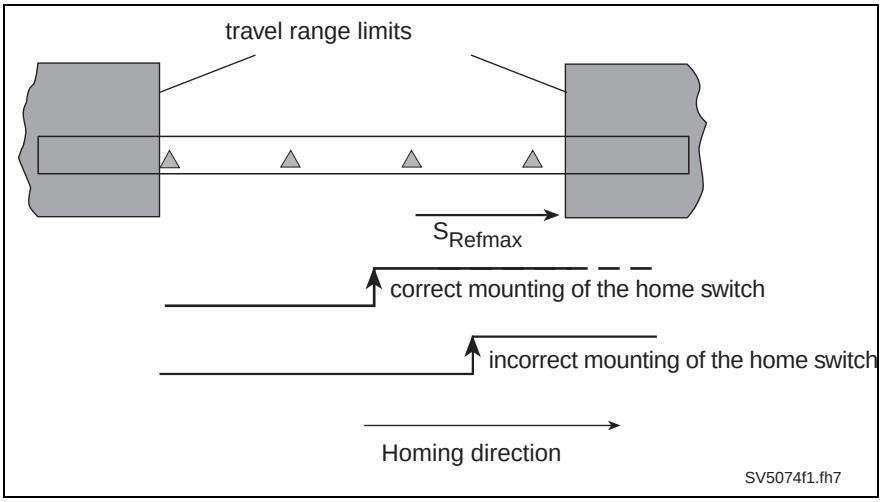


Fig. 8-96: Mounting the home switch with distance coded reference markers

Functions of the Control During "Drive-Controlled Homing"

The control's interpolator must be set to the position command value read from the drive.

During "drive-controlled homing", the drive independently generates its position command values. Preset command values of the control will be ignored. If the command is confirmed by the drive as completed, the position command value corresponding to the machine zero point will be made available in parameter **S-0-0047, Position command value**. This value must be read through the service channel by the control before ending the command, and the control interpolator must be set to this value. If this command is completed by the control and if the command values of the control for the drive become active again, these values should be added to the value read out of the drive.

Starting, interrupting and completing the command "Drive-Controlled Homing"

This feature is implemented as a command.

To start the feature, you must set and execute the command by writing to the parameter **S-0-0148, C600 Drive controlled homing procedure command** (Input = 3 = 11bin). The drive confirmation has to be received from the data status out of the same parameter. The command is finished when the command-change bit in the drive status word is set and the confirmation changes from *in process* (7) to *command executed* (3) or to *command error* (0xF).

If the command is interrupted (Input = 1) during processing (when confirmation = 7), the drive responds by activating the drive halt feature. The program continues if the interruption is canceled.

(See also chapter: "Drive Stop".)

Possible Error Messages During "Drive-Controlled Homing"

During the execution of the command, the following command errors can occur:

- **C601 Homing only possible with drive enable**
  While starting the command, the controller enable was not set.
- **C602 Distance home switch - reference mark erroneous**
  The distance between home switch and reference mark is too small, see Monitoring the Distance Between Home switch and Homing Mark on page 8-82
- **C604 Homing of absolute encoder not possible**
  The homing encoder is an absolute encoder. The command "Drive-Controlled Homing" was started without first starting the command "Set Absolute Measuring".

Configuration of the Home switch

Note: The home switch should be set up far enough that the "actuated" range covers more than the permissible motion range. Otherwise, the travel range may be overrun at command start if the start position is in an unfavorable position. Damage to the system is possible !

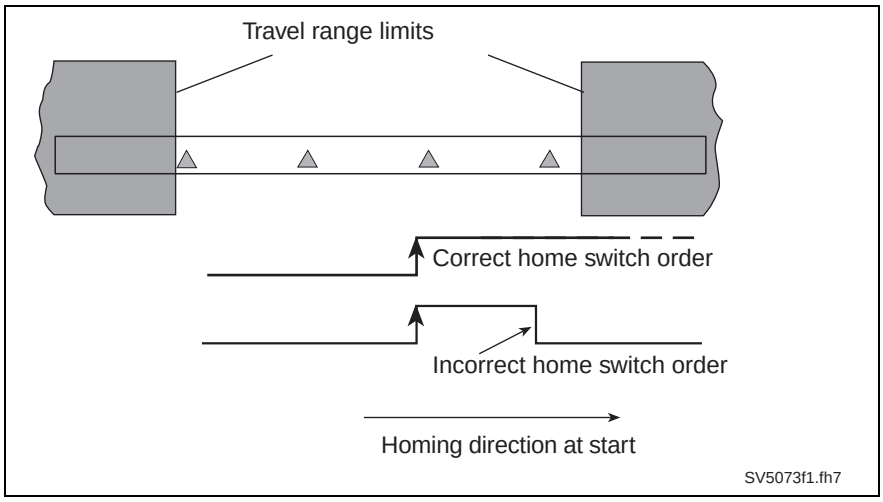


Fig. 8-97: Configuration of the home switch in reference to the travel range

Connection of the Home switch

see project planning manual.

8.10 Setting the Absolute Dimension

When commissioning an absolute measuring system, the initial actual position value represents just any point on the machine and not the machine zero point.

Note: The value of **S-0-0403, Position feedback value status** is "0".

Establishing the absolute reference

In contrast to non-absolute measuring systems, finding the absolute dimension of an absolute measuring system is something that only has to be done once, namely at the time that the axis is commissioned.

With the use of command "**C300 Set absolute measuring**" the actual position value of this measuring system can be set to the desired value. After "Setting the absolute dimension" procedure has been completed, then the actual position value of the relevant encoder has a defined reference point for its machine zero point.

Activating the function

The command can be triggered by:

- writing into parameter **P-0-0012, C300 Command 'Set absolute measurement'**
- or with a zero switch input flank.

Command reference point

If there is only one absolute measuring system, then the command automatically references this one system. Given two absolute systems, however, then the selection must be set in **Bit 3** of **S-0-0147, Homing parameter**.

Saving the data

All information is retained by buffering all the data of the system in a feedback memory or a parameter memory. The actual position value retains its reference to the machine zero point each and every time the machine is switched on after being switched off.

Pertinent Parameters

The following parameters are relevant to the execution of commands:

- **P-0-0012, C300 Command 'Set absolute measurement'**
- **P-0-0612, Control word for setting absolute measurement**
- **S-0-0147, Homing parameter**
- **S-0-0052, Reference distance 1**
- **S-0-0054, Reference distance 2**
- **S-0-0403, Position feedback value status**

Functional Principle of Setting the Absolute Dimension

The motor is brought to a precise position. The value of the actual position of the measuring system is entered in parameters **S-0-0052, Reference distance 1** (for motor encoders) or **S-0-0054, Reference distance 2** (for any other encoders).

Upon successful completion of command **P-0-0012, C300 Command 'Set absolute measurement',** the actual position value is set to that value entered in the relevant **Reference dimension** and after **S-0-0403**, **Position feedback value status** has been set to **"1"**.

Control word setting the absolute dimension

The execution of the command depends on **P-0-0612, Control word for setting absolute measurement** the absolute dimension. The decision must be made here whether the drive enable is applied at command start or not.

Parameter Structure:

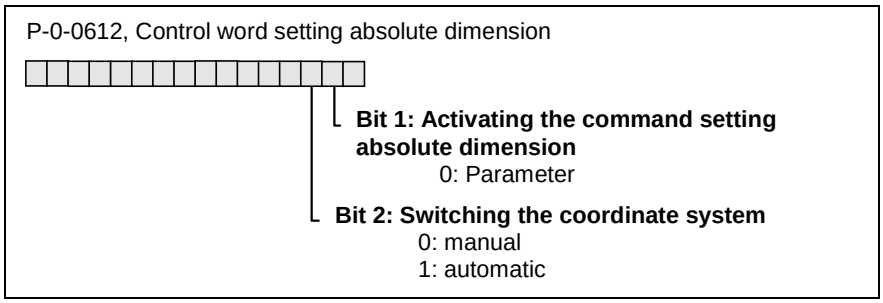

P-0-0612, Control word setting absolute dimension
Bit 1: Activating the command setting absolute dimension
0: Parameter
Bit 2: Switching the coordinate system
0: manual
1: automatic

Fig. 8-98: P-0-0612, Control word setting the absolute dimension

The command

"Setting the absolute dimension" without drive enable

Bit1 of **P-0-0612** is used to select whether the command is started

- by writing into parameter **P-0-0012** with "11b" (if bit1 ="0") or
- a 0->1 flank at the zero switch input (if bit1 ="1").

Switching the coordinate system

Note: If the drive enable is not applied and command "Setting the absolute dimension" is started, then drive-internally the coordinate system is always automatically and immediately switched (bit 2 is not relevant in this case!).

Case	P-0-0612	Behavior when executing the command
A1	Bit1 = 0 Bit2 = x	Setting the absolute dimension by conducting **P-0-0012, C300 Command 'Set absolute measurement** • by writing "11b" into **P-0-0012,** then, in addition to command start "Setting the absolute dimension", the coordinate system is also automatically switched.
B1	Bit1 = 1 Bit2 = x	**Setting the absolute dimension with a 0-1 flank at the reference switch input** • a 0->1 flank at zero switch input stores the actual position • and the coordinate system is also immediately switched

Fig. 8-99: Overview: setting the absolute dimension without drive enable

Case A1: When activating the command by writing into the parameter, proceed as follows:

- The axis must be brought into the precisely measured position.
- The actual position value of the position wanted must be entered.
- The command can be started by writing "11b" into **P-0-0012, C300 Command 'Set absolute measurement"**.
- The command immediately sets the actual position value of the measuring system to the reference dimension and the position status becomes "1". The drive completes the command which can now be cleared (**P-0-0012** ="0").

Case B1: Basically same procedure as with Case A1, but the command is activated by the flank at the zero switch input.

Note: Bit1 of P-0-0612 and the command itself are deleted automatically and drive-internally upon completion of "Setting the absolute dimension"!

"Setting the absolute dimension" with drive enable

If the application uses a so-called "vertical axis" or the position approached without drive enable cannot, for whatever reason, be held, then the command can also be executed with drive enable.

The command With bit1 of **P-0-0612** it is set whether the command is started by

- writing "11b" into **P-0-0012** (bit 1 ="0") or
- a 0->1 flank at the zero switch input (bit 1 ="1").

Note: For safety reasons, flank evaluation is automatically deactivated after "Setting the absolute dimensions" has been completed. This means that applications in systems with slip must cyclically use bit 1 in P-0-0612.

Switching the coordinate system

Use bit2 of **P-0-0612** to select whether, when executing command **P-0-0012, C300 Command Setting the absolute dimension,**

- there is also an immediate drive-internal switch of the coordinate system (bit 2 ="1") or
- the start of **S-0-0148, C600 Drive controlled homing procedure command** is delayed until the drive enable is removed by the control before the coordinate system is switched (bit 2 ="0").

Case	P-0-0612	Behavior when executing the command
C1	Bit1 = 0 Bit2 = 0	By writing "11b" into **P-0-0012, C300 Command 'Set absolute measurement'**" the command is started but the coordinate system not switched. By starting the command **S-0-0148** or removing RF, the coordinate system is switched
C2	Bit1 = 0 Bit2 = 1	By writing "11b" into **P-0-0012, C300 Command 'Set absolute measurement'"** the command is immediately started and the coordinate system switched
D1	Bit1 = 1 Bit2 = 0	a 0->1 flank at the zero switch input stores the actual position and starts command **S-0-0148** but the control waits to switch the coordinate system!
D2	Bit1 = 1 Bit2 = 1	a 0->1 at the zero switch input stores the actual position and immediately switches the coordinate system

Fig. 8-100: Overview: setting the absolute dimension with drive enable

Note: Make sure that an encoder has been programmed in bit 3 of **S-0-0147, Homing parameter.**

Case C1:

In the event that the coordinate system switch does not automatically take place drive-internally, (**P-0-0621,** bit 2 ="0"), then proceed as follows:

- take the axis to the measured position
- enter the actual position value wanted into the relevant reference dimension actual position value parameter
- Start command **P-0-0012, C300 Command 'Set absolute measurement'** (write "11b" into P-0-0012"). There is no switching of position data as yet.
- Start command **S-0-0148, C600 Drive controlled homing procedure command** or remove drive enable. This function recognizes that it is dealing with an absolute measuring system and conducts "Setting the absolute dimension". In other words, the actual position value is set to the reference dimension. The position command value is simultaneously set to the same value (**S-0-0047, Position command value**). If the drive is in "Position control" mode, then the position command value must be read via the acyclical parameter channel (e.g., service channel with SERCOS) and the position command value of the control set to this value before the referencing command is cleared.
- Clearing command "**C300 Set absolute measuring** the absolute **dimension"**

Case C2: In the event that the coordinate system is to be automatically and drive-internally switched at the start of command "Setting the absolute dimension" **(P-0-0621**, Bit 2 ="1**")** then proceed as follows:

- Bring the axis to the measured position.
- Enter the desired actual position value in the relevant reference dimension actual position value parameter.
- Start command **C300 Set absolute measuring** the absolute dimension (write "11b" into P-0-0012") and position data are also automatically switched.
- Drive-internally and automatically command **S-0-0148, C600 Drive controlled homing procedure command** is started. With command execution, the drive recognizes that it is dealing with an absolute measuring system and conducts "Setting the absolute dimension". In other words, the actual position value is set to the reference dimension. The position command value is simultaneously set to the same value (**S-0-0047, Position command value**). In position control mode this automatically leads to the automatic switch of the coordinate system, but as the control cannot bring its command value immediately upto the new actual value, there is an abrupt transition.
- Clear command **P-0-0012, C300 Command 'Set absolute measurement'.**

Case D1: In the event that the coordinate system switch is not automatic and drive-internal (**P-0-0621**, Bit 2 ="0"), then basically the same procedure as with case C1 should be followed, but the command is here activated by a flank at the zero switch input.

- Activate the zero switch input by setting **P-0-0612,** Bit1="1".
- Run the axis to the measured position (e.g., jog it there).
- and so on ...

Note: Both bit1 of **P-0-0612** and the command itself are automatically, drive-internally deleted after "Setting the absolute dimension"!

Case D2: If the coordinate system is to be switched drive-internally and automatically at the start of command "Setting the absolute dimension" **(P-0-0621,** Bit 2 ="1"), then basically proceed as with case C2 but here the command is activated by a flank at the zero switch input.

- Activate the zero switch input with **P-0-0612,** Bit1="1"
- Run the axis to the measured position (e.g., jog it there).
- and so on ....

Note: Both bit1 of **P-0-0612** and the command itself are auttomatically, drive-internally deleted after "Setting the absolute dimension"!

Actual Position Value after Setting the absolute dimension

The state of the actual position value of the motor encoder, and any other encoders that might be mounted, after the execution of the setting the absolute dimension command depends on bit 3 in **S-0-0147, Homing parameter** and whether the absolute encoder is a motor or an optional encoder.

Motor encoder	Optional encoder	S-0-0147 Bit 3:	Actual position value 1	Actual position value 2
absolute	not absolute or not there	any	Reference dimension 1	Reference dimension 1
not absolute	absolute	any	Reference dimension 2	Reference dimension 2
absolute	absolute	0	Reference dimension 1	unchawnged
absolute	absolute	1	unchange	Reference dimension 2

Fig. 8-101: Actual position value after setting the absolute dimension

Actual position value of absolute encoders after power on

(See section: "Actual position value of absolute measuring systems after initialization".)

Diagnoses

While executing the command it is possible that command error "**C302 Absolute measuring system not installed**" is generted once command **P-0-0012, C300 Command 'Set absolute measurement'** is started without an absolute measuring system having been installed.

Hardware Connections

See project planning zero switch input (temrinal X3 pin1).

9 Optional Drive Functions

9.1 Configurable Signal Status Word

The configurable signal status word supports the acceptance of a maximum of 16 copies of bits from other drive parameters. This makes it possible for a user to put a bit list together which contains status information of the drive that important to the control.

Note: The bits in the signal status are put together in every command communication cycle at **S-0-0007, Feedback acquisition starting time (T4)**.

Pertinent Parameters

These parameters are used with this function:

- **S-0-0144, Signal status word**,
  The desired bits are applied there.
- **S-0-0026, Configuration list signal status word,**
  ID number list with variable length to configure the bit strip.
- **S-0-0328, Assign list signal status word**
- Bit number list with variable length to configure the bit strip.

Configuration of the Signal Status Word

Configuration of the ID number

Parameters **S-0-0026, Configuration list signal status word** and **S-0-0328, Assign list signal status word** are used to configure the signal status word. These parameters have a variable length of two byte data elements.

The ID numbers of the parameters which contain the original bits (sources) are specified in parameter **S-0-0026, Configuration list signal status word.** The position of an ID number in the list determines the bit in the signal status word to which the ID number applies. So the first list element informs as to what parameter bit 0 of the signal status word comes from.

Configuring the bit numbers

Which bit of the parameters selected in **S-0-0026, Configuration list signal status word** is to be copied into the signal status word is determined in **S-0-0328, Assign list signal status word**.

Note: If this list remains empty, then bit 0 of the parameter is automatically copied. Otherwise, the bit taken out of the source parameter is specified here.

Bit number 0 (LSB) to 31 (MSB) can be specified. For each bit number of this list there must be an ID number in the same list position in list S-0-0026. Otherwise, the drive, when writing the bit number list, will issue the error message "ID number not available". This is why list **S-0-0026, Configuration list signal status word** must be written into before **S-0-0328, Assign list signal status word**.

Example: A signal status word with the following configuration must be put together:

Bit no. in S-0-0144,Signal status word	ID number of original parameter	Bit no. of original parameter	Definition
0	S-0-0013	1	Vist = 0
1	S-0-0182	6	IZP
2	S-0-0403	0	position status
3	P-0-0016	4	P-0-0015 specifying memory address of a drive-internal counter. Transmission is from bit 4

Fig. 9-1: Example of a configurable signal status word

Note: A maximum of 16 bits can be configured. Configuration is performed from the least-significant to most-significant bit. In other words, the position of the bit copy in the siganl status word is the result of the continuous configuration in **S-0-0026**.

Diagnostic / Error Messages

The following checks are run when inputting parameters **S-0-0328, Assign list signal status word** or **S-0-0026, Configuration list signal status word**:

- If more elements are programmed in **S-0-0328, Assign list signal status word** than **S-0-0026, Configuration list signal status word** then error message "*0x1001, ID number not available*" is generated.
- If an ID number specified in **S-0-0026, Configuration list signal status word** does not exist, then error message "*0x1001, ID number not available*" is generated.
- Check whether the IDN variable data length (list parameters) specified in **S-0-0026, Configuration list signal status word** exists or a socalled online read function. Parameters with online read function are generally parameters with physical units (position, speed, acceleration and currents) as well as parameters **S-0-0135, Drive status word** and **S-0-0011, Class 1 diagnostics**. If yes, then service channel error message *0x7008, Data not correct* is generated.

Note: In each of these cases, only the inputs up until the faulty element is accepted!

9.2 Configurable Signal Control Word

With the signal control word it is possible to write access single control bits in the various parameters by using a freely-configurable collective parameter.

The configurable signal control word supports acceptance of a maximum of16 copies of bits from other drive parameters.

Accessing signal control word

Depending on the **command communications** parameter **S-0-0145, Signal control word** is accessed in various ways:

- With SERCOS and fieldbus interface, **S-0-0145, Signal control word** must be relevantly configured in cyclical data so that the mechanism can be used.

Note: The bits in the signal control word are effective in each interface cycle at S-0-0008, Command valid time (T3).

Involved Parameters

The following parameters are used for the funtions

- **S-0-0027, Configuration list signal control word**
- **S-0-0329, Assign list signal control word**
- **S-0-0145, Signal control word**
- **S-0-0399, IDN list of configurable data in the signal control word**

Configuring the Signal Control Word

Selection lists

Only those parameters in list **S-0-0399, IDN list of configurable data in the signal control word** can be allocated to configuration list **S-0-0027, Configuration list signal control word**.

Configuration of the ID numbers

The ID numbers of the parameters which are to be configured with the help of the signal control word (=target) are specified in parameter **S-0-0027, Configuration list signal control word.**

The position of an ID number in the list determines which bit in the signal control word is allocated to which ID number (target). For example, the first list element fixes which parameter bit 0 of the signal control word is allocated to.

Configuration of the bit numbers

Which bit of the selected parameters (=target in **S-0-0027, Configuration list signal control word)** is set by the signal control word (or reset) is set in **S-0-0329, Assign list signal control word**.

Note: If this list remains empty, then bit 0 is automatically set in the specified parameters. Otherwise, the bit which is allocated to the target parameters is specified here.

Bit numbers from **0 (LSB) to 31 (MSB)** are entered here.

Exceptions

If the allocated parameter is a command, then the bit number in parameter **S-0-0329, Assign list signal control word** is not relevant.

If the allocated parameter is parameter **S-0-0346, Setup flag for relative command values**, then a positive edge in the relevant bit of the control word effects a toggling of the parameter **S-0-0346, Setup flag for relative command values**.

ID number not available

For every bit number in list **S-0-0329, Assign list signal control word** there must be an ID number at the same list position in the list in **S-0-0027, Configuration list signal control word**. Otherwise, when writing the bit number list from the drive, error message "ID number not available" will be generated.

Note: This is why list S-0-0027 must be written prior to list S-0-0329.

Example:

Bit no. In S-0-0145	ID number of the target parameter	Bit no. of the target parameter	Definition
0	P-0-4026	0	select positioning block
1	P-0-4026	1	select positioning block
2	P-0-4026	2	select positioning block
3	P-0-4026	3	select positioning block
4	P-0-4026	4	select positioning block
5	P-0-4026	5	select positioning block
6	S-0-0346	0	start (strobe)
7	S-0-0148	0	start referencing command
8	P-0-4056	0	jog positive
9	P-0-4056	1	jog negative

Fig. 9-2: Example for configuration signal control word (= default setting)

Note: Up to **16 Bits** can be configured. Configuration takes place from the lowest to the highest value bit. In other words, The position of the bit copy in the signal control word is derived from the continuous configuration in S-0-0027.

Diagnostic / Error Messages

When inputting one of the parameters (S-0-0027 or S-0-0329) the following checks are run:

- If more elements are programmed in **S-0-0329, Assign list signal control word** then in **S-0-0027, Configuration list signal control word**, then error message "*0x1001, ID number not available*" is generated.
- If an ID number specified in **S-0-0027, Configuration list signal control word** is not available, then error message "*0x1001, ID number not available*" is generated.
- If an ID number specified in **S-0-0027, Configuration list signal control word** is not on the list of the configured data S-0-0399 then error message "*0x7008, Data not correct"* is generated.

Note: In each of these cases, only that input prior to the faulty element will be accepted!

9.3 Analog Output

With the help of the function "Analog output" drive-internal signals and state variables can be generated as analog voltage signals. These can be examined with an oscilloscope connected to the analog outputs.

The conversion of the digital values from the drive is done via two 8 bit digital-to-analog converters. The maximum output voltage equals +/- 10 volts. There is an output every 500 usec.

Possible output functions

1. Direct writing into the analog outputs
2. Assigning ID numbers to analog outputs
3. Output of pre-set signals
4. Byte output of RAM memory cell
5. Bit output of RAM memory cells

To parametrize the function, the following parameters are available:

- **P-0-0139, Analog output 1**
- **P-0-0140, Analog output 2**
- **P-0-0420, Analog output 1, signal selection**
- **P-0-0421, Analog output 1, expanded signal selection**
- **P-0-0422 Analog output 1, scaling**
- **P-0-0423, Analog output 2, signal selection**
- **P-0-0424, Analog output 2, expanded signal selection**
- **P-0-0425, Analog output 2, scaling**
- **P-0-0426 Analog outputs, IDN list of assignable parameters**

Direct analog outputs

With the parameters **P-0-0139, Analog output 1** and **P-0-0140, Analog output 2** it is possible for the control to use the two 8 bit digital/analog converters of the drive. Voltage values written into these parameters, ranging between -10.000 volts and +10.000 volts, are output by the drive to the analog outputs. The quantization equals 78 mV.

A precondition for the use of an analog output is that the signal selection (P-0-0420 or P-0-0423) and the expanded signal selection (P-0-0421 or P-0-0424) were deactivated by inputting 0 for the used channel.

Analog output of existing parameters

selection list All parameters in the list **P-0-0426 Analog output, IDN list of assignable parameters** can be output analog.

configuration This first requires that their ID number be input in the signal select for channel 1 (P-0-0420) or 2 (P-0-0423). The unit and the attribute (number of decimal places) of the relevant scaling (P-0-0422 or P-0-0425) is set as per the selected parameter. If the selected parameter depends on a scaling mode, then the settings there apply to the scaling as well.

scaling

With **P-0-0422 Analog output 1, scaling** or **P-0-0425, Analog output 2, scaling** is it then fixed at what value 10 volts are output.

For example, for rotary preferred position scaling and signal selection position command (S-0-0047), the unit of the scaling factor is set to degrees, and the number of decimal places is set to four. Inputting 90.0000 degrees in the evaluation factor means that 10 volts per 90 degrees at the load will be output .

If signals with a binary format are selected (e.g., **S-0-0134, Master control word)** then the display format of the scaling is set to decimal without fractional part. There is no unit. With this scaling, a bit number between 0 and 15 is selected. The state of this bit of the set parameter is then output in such a way that for logical 0 -10 volts are output and for logical 1 +10 volts (bit output).

Outputting pre-set signals

To be able to show such signals in an analog manner, which do not exist as a parameter, there a way to select these via predefined signal numbers and to output these via the expanded analog output.

The parameters

- **P-0-0421, Analog output 1, expanded signal selection** and
- **P-0-0424, Analog output 2, expanded signal selection**

do the selection.

Activation of the expanded output

The expanded output only functions if the signal select for the channel used (P-0-0420 or P-0-0423) is deactivated by inputting the ID number 0.

The following list shows which signal is output with which signal number.

Signal number P-0-0421/424	Output signal	Reference unit: Evaluation factor 1.0000
0x00000001	motor encoder sine signal	0.5V/10V
0x00000002	motor encoder cosine signal	0.5V/10V
0x00000003	Opt. enc. sine signal	0.5V/10V
0x00000004	Opt. enc. sine cosine	0.5V/10V
0x00000005	Position command difference on the pos. controler	rot. ⇒ 1000rpm/10V lin. ⇒ 100m/min/10V
0x00000006	DC bus power	1kW/10V
0x00000007	absolute DC bus power amount	1kW/10V
0x00000008	effective current	S-0-0110/10V
0x00000009	relative current	S-0-0110/10V
0x0000000a	thermal load	100 % / 10V
0x0000000b	motor temperature	150°C/10V
0x0000000c	magnetizing current	S-0-0110/10V
0x0000000d	velocity command at the velocity controller	rot. ⇒ 1000rpm/10V lin. ⇒ 100m/min/10V

Fig. 9-3: Signal selection list with pre-defined signal selection

See also Control loop structure in chapter General Information for Control Loop Settings

This information is scaling independent and always relates to the motor shaft. The scaling of the signals is possible via the parameters **P-0-0422 Analog output 1, scaling** and **P-0-0425 Analog output 2, scaling.** These have been set as factors with 4 decimal places in the expanded signal selection. If the evaluation factors are 1.0000, then the standards specified in the table apply.

Example: Output of the position command difference with a value of 150rpm/10V on channel 1.

Input:

P-0-0420, Analog output 1, signal selection = S-0-0000

P-0-0421, Analog output 1, expanded signal selection = 0x00000005

P-0-0422 Analog output 1, scaling = 0.1500

Bit and byte outputs of the data memory

note: Use of this feature is meaningful only with information about the structure of the internal data memory; therefore, this feature can be used effectively only by the corresponding developer

activation of the bit and byte output

The bit and byte output is only possible if the signal selection for the used channel (P-0-0420 or P-0-0423) is deactivated by inputting the ID number 0.

configuration

The selection of the function and the storage address takes place in the parameters

- **P-0-0421, Analog output 1, expanded signal selection** and
- **P-0-0424, Analog output 2, expanded signal selection.**

In the high nibble (half byte with bits 28..31), byte output is activated with a 1 and bit output with a 2. The least significant 24 bit of the parameter inputs the storage address.

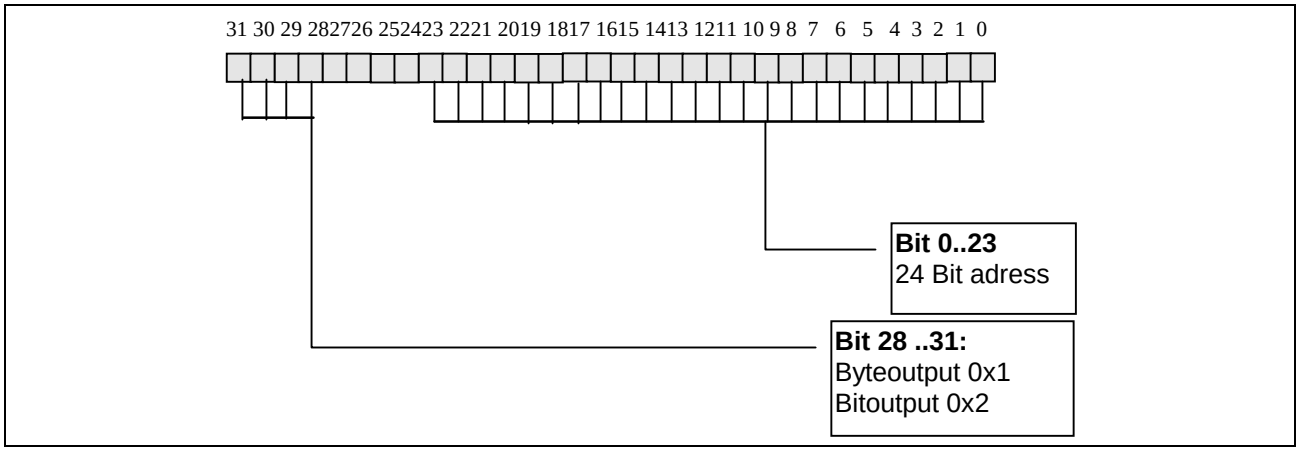


Fig. 9-4: Parametrizing bit or byte output

scaling

The parameters

P-0-0422 Analog output 1, scaling and

P-0-0425 Analog output 2, scaling

either select the bit to be output or it can be determined from which (least signifiant) bit on the byte to be generated will start. When selecting the bit

number, only values between 0 and 15 make sense. If greater values are entered, then only bits 0..3 are used.

When outputting bits, -10 volt (bit = 0) or +10 volt (bit = 1) is output.

Byte output With byte outputs, the MSB of the byte to be output is interpreted as sign bit. Voltages ranging from -10 to +10 volts are output.

Terminal assignment - analog output

see project planning manual.

9.4 Analog Inputs

Using the function "Analog inputs", two analog inputs can be used via analog/digital converters in one parameter each. The analog voltages, in the form of both of these parameters, can then either be

- transmitted to the control and supports the control as an analog input function or
- it can be assigned in the drive to a different parameter taking a settable scaling and a settable offset into account.

Note: With the help of analog inputs it is also possible to set specific command values for velocity control mode.

Pertinent Parameters

The following parmeters are available for the function:

- **P-0-0210, Analog input 1**
- **P-0-0211, Analog input 2**
- **P-0-0212, Analog inputs, IDN list of assignable parameters**
- **P-0-0213, Analog input 1, Assignment**
- **P-0-0214, Analog input 1, Scaling per 10V**
- **P-0-0215, Analog input 2, Assignment**
- **P-0-0216, Analog input 2, Scaling per 10V**
- **P-0-0217, Analog input 1, Offset**
- **P-0-0218, Analog input 2, Offset**

Functional principle of the analog inputs

The two analog inputs are connectet over two **differential inputs** E1+ / E1- and E2+ / E2- .

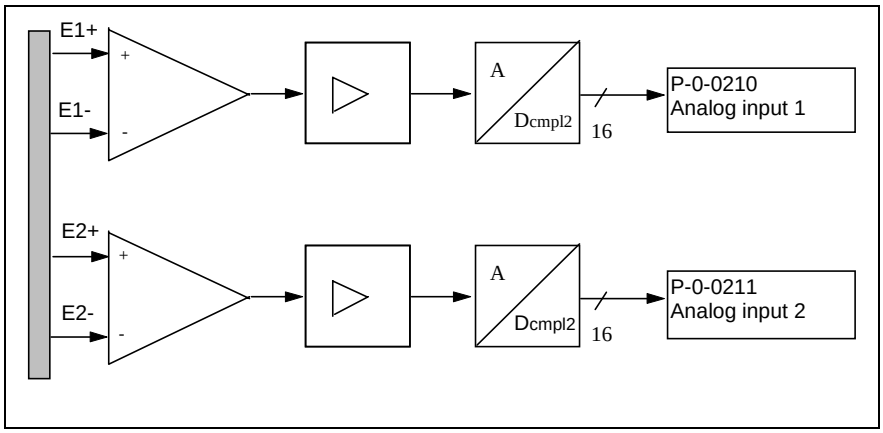


Fig. 9-5: Functinal principle of the analog inputs

The digitalized voltages of both differential inputs are displayed in the parameters **P-0-0210, Analog input 1** and **P-0-0211 Analog input 2.** The analog/digital conversion is performed via a two channel 14Bit ADC with fourfold oversampling.

Assignment of analog inputs to parameters

Both **P-0-0210, analog input 1** and **P-0-0211 analog input 2**, which depict the analog-to-digital converted voltages, can be assigned to other drive parameters, i.e., they can be cyclically copied while taking

- an offset and
- a selectable scaling

into account.

- Analog channel 1 is processed every 1ms
- Analog channel 2 is processed every 8 ms

Exception: In modes "velocity control" or "torque control", the command values are read every **500 µs**.

The assignment applies the following principle:

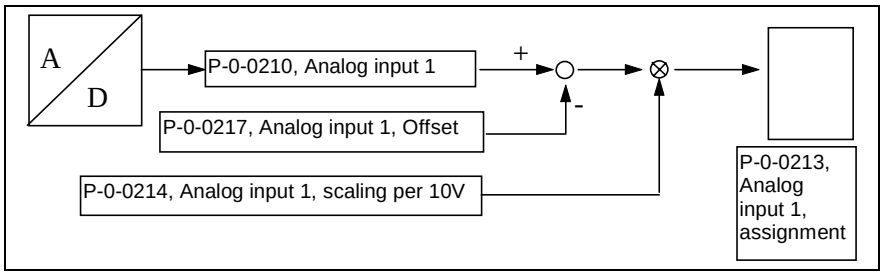


Fig. 9-6: Functional principle of assigning analog input 1 to a parameter

Displaying analog value 1

The converted voltage signals of both differential inputs are stored in parameter **P-0-0210, Analog input 1** respectively.

Configuring the analog input 1

An assignment of an analog input to a parameter is activated if in parameter **P-0-0213, Analog input 1, assignment** a value not equal to S-0-0000 has been parametrized. The contents of **P-0-0210, Analog input 1** minus the contents of **P-0-0217, Analog input 1, Offset** is scaled with the scaling factor set in **P-0-0214, Analog input 1, Scaling per 10V** and then copied into the parameter with the ID number set for the assignment in **P-0-0213, Analog input 1, Assignment**.

Evaluation parameter unit

The **unit** of the parameter **P-0-0214, Analog input 1, Scaling per 10V** complies with the unit of the assigned parameter.

Selection list

Only those parameters can be assigned that are listed in **P-0-0212, Analog inputs, IDN list of assignable parameters**.

Configuring analog input 2

Note: The configuration or allocation of analog input 2 can be conducted accordingly.

Example:

Assignment of analog input 1 to **S-0-0036, velocity command value** with 10 V equal to 1000 rpm

Parameter setting:

P-0-0213, analog input 1 = S-0-0036

P-0-0214, analog input 1, evaluation per 10V = 1000.0000 rpm

Analog Inputs - Connection

See project planning manual.

9.5 Oscilloscope Feature

The oscilloscope feature is used to diagram internal and external signals and output variables. Its function is comparable to a 2-channel oscilloscope. The following parameters are available to set the oscilloscope feature:

- **P-0-0021, List of Scope Data 1** (always 4-byte data)
- **P-0-0022, List of Scope Data 2** (always 4-byte data)
- **P-0-0023, Signal Select Scope Channel 1**
- **P-0-0024, Signal Select Scope Channel 2**
- **P-0-0025, Trigger Source**
- **P-0-0026, Trigger Signal Selection**
- **P-0-0027, Trigger Level for Position Data**
- **P-0-0028, Trigger Level for Velocity Data**
- **P-0-0029, Trigger Level for Torque/Force Data**
- **P-0-0030, Trigger Edge**
- **P-0-0031, Timebase**
- **P-0-0032, Size of Memory**
- **P-0-0033, Number of Samples after Trigger**
- **P-0-0035, Delay from Trigger to Start** (cannot be written)
- **P-0-0036, Trigger Control Word**
- **P-0-0037, Trigger Status Word**
- **P-0-0145, Expanded Trigger Level**
- **P-0-0146, Expanded Trigger Address**
- **P-0-0147, Expanded Signal K1 Address**
- **P-0-0148, Expanded Signal K2 Address**
- **P-0-0149, List of selectable signals for oscilloscope function**
- **P-0-0150, Number of valid Samples for Oscilloscope Function**

Main Functions of the Oscilloscope Feature

The oscilloscope feature can be activated with the parameter **P-0-0036, Trigger Control Word** by setting bit 2. From then on, all data will be recorded that was selected through the parameters **P-0-0023, Signal Selection Channel 1** and **P-0-0024 Signal Selection Channel 2**. The selection will be defined with numbers that are assigned to various signals.

The triggering is activated by setting the bit 1 in the "Trigger Control Word" parameter. The trigger conditions can be set with the parameters **P-0-0025, Trigger Source, P-0-0026, Trigger Signal Selection** and **P-0-0030 Trigger Edge**. The signal amplitude that releases the trigger can be set with the parameters **P-0-0027 - P-0-0029 Trigger Level**.

If a trigger event is recognized, then the number of values in the parameter **P-0-0033 Number of Samples after Trigger** will be recorded, and the function will end. Parameters **P-0-0031 Timebase** and **P-0-0032 Size of Memory** can define the recording duration and the time intervals for the measurement samples.

The sampled values are stored in the **P-0-0021 and P-0-0022 List of scope data** and can be read by the control.

Parameterizing the Oscilloscope Feature

Oscilloscope feature with defined recording signals

Preset signals and state variables can be selected through the **P-0-0023 and P-0-0024 Signal Selection** parameters. The selection can be made by entering the signal number (hex format) in the corresponding signal selection parameter. The selected signal number defines the unit of data stored in the list of scope data. The following signals are predefined with numbers.

Number:	Signal selection:	Unit of the probe value list:
0x00	Channel not activated	--
0x01	Actual position feedback value dependent on operating mode S-0-0051 or S-0-0053	dependent on position scaling
0x02	Velocity feedback value Parameter (S-0-0040)	velocity scaling dependent
0x03	Velocity control deviation (S-0-0347)	velocity scaling dependent
0x04	Following error Parameter (S-0-0189)	dependent on position scaling
0x05	Torque/force command value Parameter S-0-0080	Percent
0x06	Position feedback 1 value S-0-0051	dependent on position scaling
0x07	Position feedback 2 value S-0-0053	dependent on position scaling
0x08	Position command value S-0-0047	dependent on position scaling

Fig. 9-7: Selection of predefined signals

Note: Parameter **P-0-0149, List of selectable signals for oscilloscope function** was introduced so that the control can detect the number of preset numbers. This parameter is constructed in terms of a list parameter and transmits the ID numbers of the possible signals.

Expanded Oscilloscope Recording Function

In addition to the oscilloscope feature with preset signals, the drive also allows for recording of any desired internal signals. Use of this feature is meaningful only with information about the structure of the internal data memory; therefore, this feature can be used effectively only by the corresponding developer. The feature can be activated with the **Signal Selection P-0-0023 & P-0-0024** parameters by setting bit 12 = "1". The format for the data to be saved can be defined with bit 13.

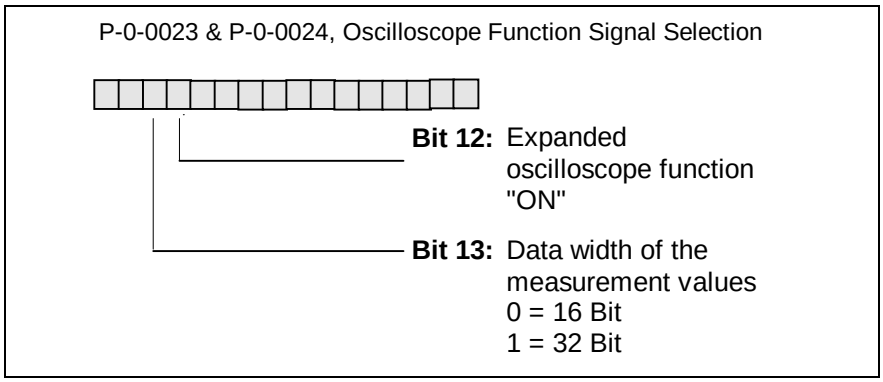

P-0-0023 & P-0-0024, Oscilloscope Function Signal Selection
Bit 12: Expanded oscilloscope function "ON"
Bit 13: Data width of the measurement values
0 = 16 Bit
1 = 32 Bit

Fig. 9-8: Structure of Parameters P-0-0023 and P-0-0024

If the expanded signal selection is parameterized, then the desired signal address can be defined in parameters **P-0-0147, Expanded signal K1 address** and **P-0-0148, Expanded signal K2 address**. During the recording process, the contents of the selected addresses are saved in the lists of scope data.

Note: If a 16-bit data width is selected, then the signal data will be stored as sign-extended 32-bit values.

Oscilloscope Feature Trigger Source

The **P-0-0025 Trigger Source** parameter makes it possible for the user to choose between two trigger types.

External trigger (P-0-0025 = 0x01)

The trigger is activated by the control through bit 0 in the **Trigger Control Word**. This makes it possible to transmit a trigger event to several drives. This parameterization supports parameter P-0-0035, which is needed to visualize the recording data.

Internal trigger (P-0-0025 = 0x02)

Triggering occurs through the monitoring of the parameterized trigger signal. If the selected edge is recognized, then the trigger will be released. The "Delay from Trigger to Start" parameter will be set to zero.

Selection of Trigger Edges

Various trigger edges can be selected with the parameter **P-0-0030 Trigger Edge**. The following options are available:

Number:	Trigger Edge:
0x01	Triggering on the positive edge of the trigger signal
0x02	Triggering on the negative edge of the trigger signal
0x03	Triggering on both the positive and negative edge of the trigger signal
0x04	Triggering when the trigger signal equals the trigger level

Fig. 9-9: Trigger edge selection

Selection of Fixed Trigger Signals

The parameter **P-0-0026 Trigger Signal Selection** determines the signal that is monitored for the parameterized edge reversal. Just as for the signal selection, there are drive-internal fixed trigger signals for the trigger signal selection. These are activated by entering the corresponding number.

The following signal numbers are possible:

Trigger signal number:	Trigger signal:	Associated trigger edge:
0x00	no trigger signal	not defined
0x01	Actual **position** feedback according to active operating mode	Position data (P-0-0027)
0x02	**Velocity** feedback value Parameter S-0-0040	Velocity data (P-0-0028)
0x03	**Velocity deviation** Parameter S-0-0347	Velocity data (P-0-0028)
0x04	**Following error** Parameter S-0-0189	Position data (P-0-0027)
0x05	**Torque command** value Parameter S-0-0080	Torque data (P-0-0029)

Fig. 9-10: Selection of fixed trigger signals

Selection of Expanded Trigger Signals

In addition to a trigger signal selection with preset signals, the drive also allows for triggering on any desired internal signal. Use of this feature is meaningful only with information about the structure of the internal data memory; therefore, this feature can be used effectively only by the corresponding developer. This feature can be activated with the parameter **P-0-0026 Trigger Signal Selection** by setting bit 12 to 1.

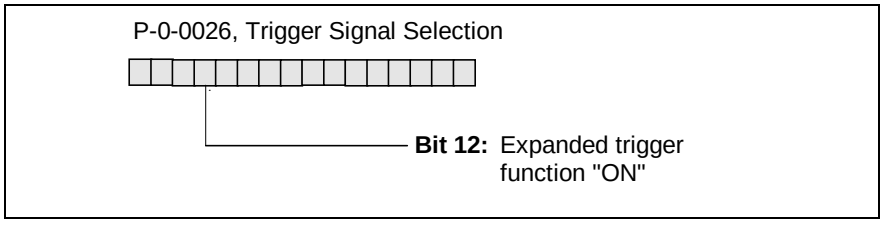


Fig. 9-11: Structure of parameter P-0-0026

If the expanded trigger feature is activated, then the trigger signal address must be defined via the parameter **P-0-00146 Expanded Trigger Address**. The associated trigger level is entered in the parameter **P-0-0145 Expanded Trigger Level**. This parameter is defined as follows:

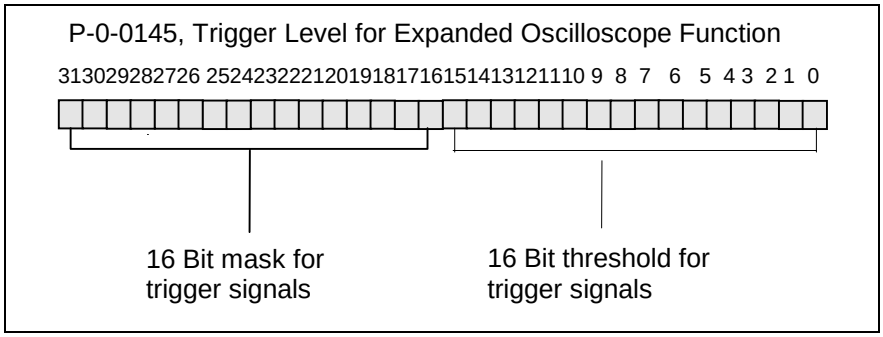

P-0-0145, Trigger Level for Expanded Oscilloscope Function
313029282726 25242322212019181716151413121110 9 8 7 6 5 4 3 2 1 0
16 Bit mask for trigger signals
16 Bit threshold for trigger signals

Fig. 9-12: Structure of parameter P-0-0145

The 16-bit value of the trigger edge is monitored and the trigger signal will be ANDed with the trigger signal screen mask.

Setting the Time Resolution and the Memory Depth

The recording ranges for the oscilloscope feature can be defined with parameters **P-0-0031 Timebase** and **P-0-0032 Size of Memory**. The maximum memory depth is 512 samples. If you need fewer samples, you can change the value in the memory size parameter.

The time resolution can be set from 500 µs to 100 ms in steps of 500 µs. This determines the time intervals in which the samples are recorded. The minimum recording duration is 256 ms; the maximum recording duration is 51.2 s.

In general:

$$\text{Recording duration} = \text{Time resolution} \times \text{Size of Memory}\,[\mu s]$$

Fig. 9-13: Determining of the recording duration

Setting the Trigger Delays

By setting the parameter **P-0-0033 Number of Samples after Trigger**, it is possible to record probe values before the trigger event occurs (trigger delay function of an oscilloscope). The setting occurs in units of the parameterized time resolution. The input value determines the number of probe values still recorded after a trigger event. By entering 0 • [time resolution], only data available before a trigger event will be recorded. If the value of the P-0-0032 Size of Memory parameter is entered, then only the probe values occurring after the trigger event will be recorded.

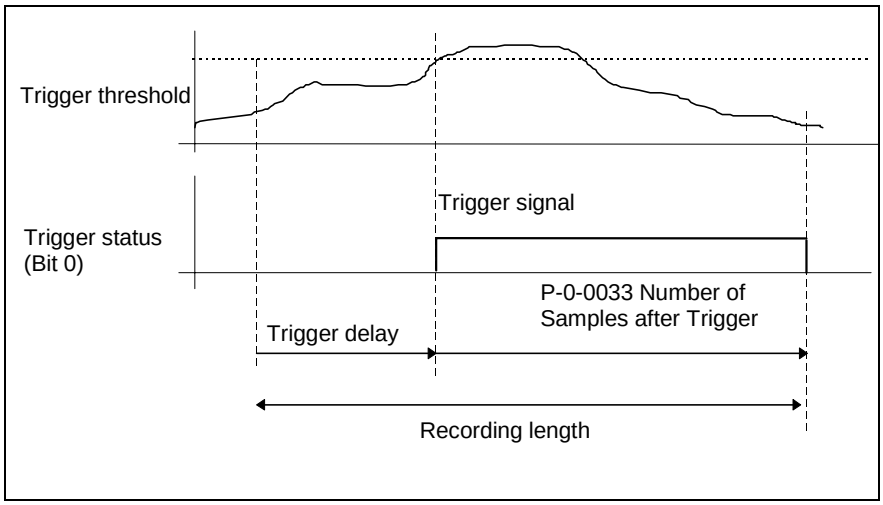


Fig. 9-14: Trigger delay - Number of samples after trigger

Activating the Oscilloscope Feature

The oscilloscope feature can be activated with the parameter **P-0-0036 Trigger Control Word**. The parameter is defined as follows:

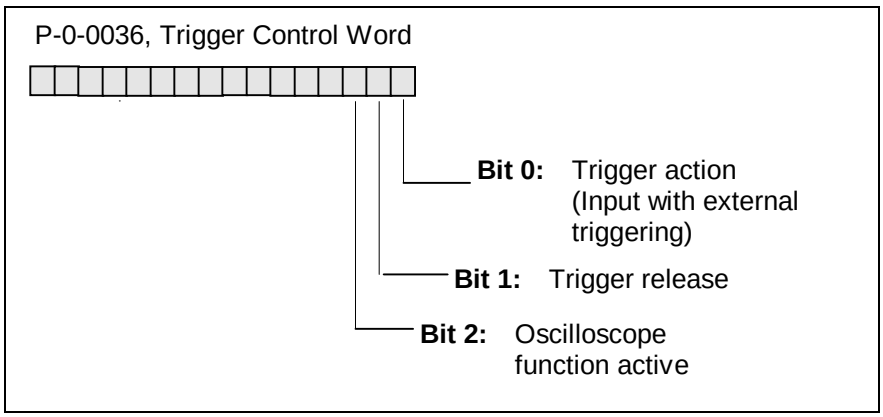


Fig. 9-15: Structure of Parameter P-0-0036

The oscilloscope feature is activated by writing "1" into bit 2; i.e., the internal probe value memory is continually written with the selected measurement signals. If bit 1 is set, then the trigger monitor is activated, and the oscilloscope feature waits for the selected edge to occur. If a valid edge is recognized, then the probe value memory will be completed as set in parameter P-0-0033, and the oscilloscope feature will be deactivated by resetting bits 1 & 2 in the trigger control word.

Oscilloscope Feature With External Trigger and Internal Trigger Condition

If triggering is selected in parameter **P-0-0025 Trigger Source** with the control bit of the trigger control word, then the trigger will be initiated with the 0→1 (rising) edge of bit 0 in the trigger control word.

With this drive, it is also possible to monitor a trigger signal for the trigger condition. If the trigger condition is recognized, then bit 0 will be set in the trigger status, but it will not trigger. In this way, it is possible to signal the trigger event for several drives simultaneously using the real-time status and control bits via the control and to release the trigger.

Since there is a delay between the recognition of the trigger event and the enabling of this trigger, the delay is measured by the drive controller and stored in the parameter **P-0-0035, Delay from Trigger to Start**. A time-correct display of the signal can be guaranteed by using this parameter for the visualization of the probe values.

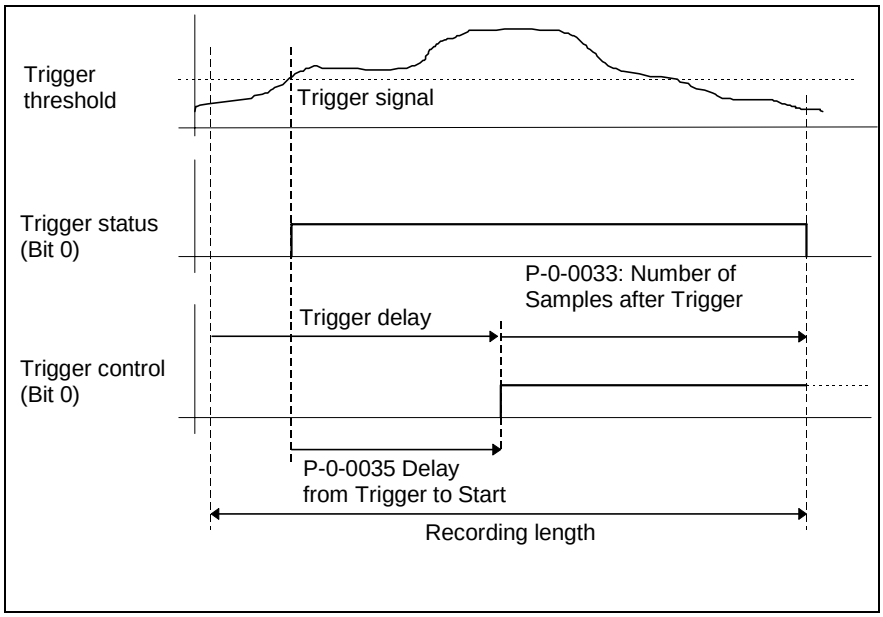


Fig. 9-16: Delay from trigger to start

Status Messages for the Oscilloscope Feature

Information about the status of the oscilloscope feature is shared with the control by means of parameter **P-0-0037, Trigger Status Word**.

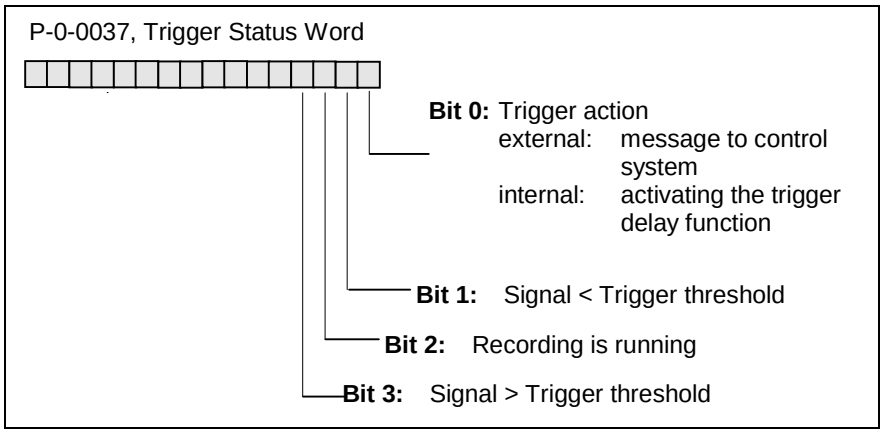


Fig. 9-17: Structure of Parameter P-0-0037

Number of Valid Probe Values

As soon as bit 2 is set by the **P-0-0036, Trigger Control Word**, the drive starts to record probe values.

If the trigger event is recognized after the bit is set, the oscilloscope feature records the number of samples after the trigger event and then stops recording.

The total probe value memory for the current measurement will not always be written, dependent on the memory size setting, the time resolution, the number of samples after trigger and the time when the trigger event occurs.

This means that the memory can contain samples which are not valid for the measurement.

The parameter **P-0-0150, Number of valid Samples** indicates the number of valid samples for the current recording.

9.6 Probe Input Feature

Two digital inputs are available for measuring positions and times. The measured values are determined at the time of the positive and negative edge.

The following measured values can be determined:

- actual position value 1
- actual position value 2
- relative internal time in [usec]

Note: The probe inputs are probed every 1 usec. The measured signals are generated every 500 usec. Linear interim interpolation takes place between these two steps with an accuracy of 1 usec.

You can read the absolute values of these signals at the time of a positive or negative edge as well as their difference by parameters.

The following parameters are available for the feature:

- **S-0-0170, Probing cycle procedure command**
- **S-0-0401, Probe 1**
- **S-0-0402, Probe 2**
- **S-0-0169, Probe control parameter**
- **P-0-0200, Signal select probe 1**
- **P-0-0201, Signal select probe 2**
- **S-0-0405, Probe 1 enable**
- **S-0-0406, Probe 2 enable**
- **S-0-0130, Probe value 1 positive edge**
- **S-0-0131, Probe value 1 negative edge**
- **S-0-0132, Probe value 2 positive edge**
- **S-0-0133, Probe value 2 negative edge**
- **P-0-0202, Difference Probe Values 1**
- **P-0-0203, Difference Probe Values 2**
- **S-0-0409, Probe 1 positive latched**
- **S-0-0410, Probe 1 negative latched**
- **S-0-0411, Probe 2 positive latched**
- **S-0-0412, Probe 2 negative latched**

Main Function of the Probe Analysis

S-0-0170, Probing cycle procedure command activates the feature. The feature is activated as a command, but does not send a command acknowledgment. The Command Change (KÄ) bit is not used.

To activate the feature, S-0-0170 must be written with 3 (decimal) = 11 binary.

From this point on, the status of the probe signals will be displayed in the parameters **S-0-401, Probe 1** and **S-0-402, Probe 2**.

A probe input is enabled with parameter **S-0-0405, Probe 1 enable** or **S-0-0406, Probe 2 enable**. With a 0-1 switch of the signal, the trigger mechanism is activated to evaluate the positive and/or negative edge of the probe signal.

From this point on, when a probe signal edge is recognized, the selected signal will be stored in the positive or negative probe value parameter. At the same time, the difference between the positive probe value and the negative probe value will be computed and saved in the probe value difference parameter. The following status messages will be set to 1: **S-0-0409, Probe 1 positive latched** and **S-0-0410, Probe 1 negative latched** or **S-0-0411, Probe 2 positive latched** and **S-0-0412, Probe 2 negative latched**.

When the probe enable is cancelled, the following status messages will be erased: **S-0-0409, Probe 1 positive latched** and **S-0-0410, Probe 1 negative latched** or **S-0-0411, Probe 2 positive latched** and **S-0-0412, Probe 2 negative latched**.

Note: Only the first positive and the first negative signal edge of the input will be evaluated after the 0→1 (rising) edge of the probe enable. For each new measurement, the probe enable must be reset to 0 and then to 1. When the probe enable is cancelled, the corresponding probe-value latched parameters are also cancelled.

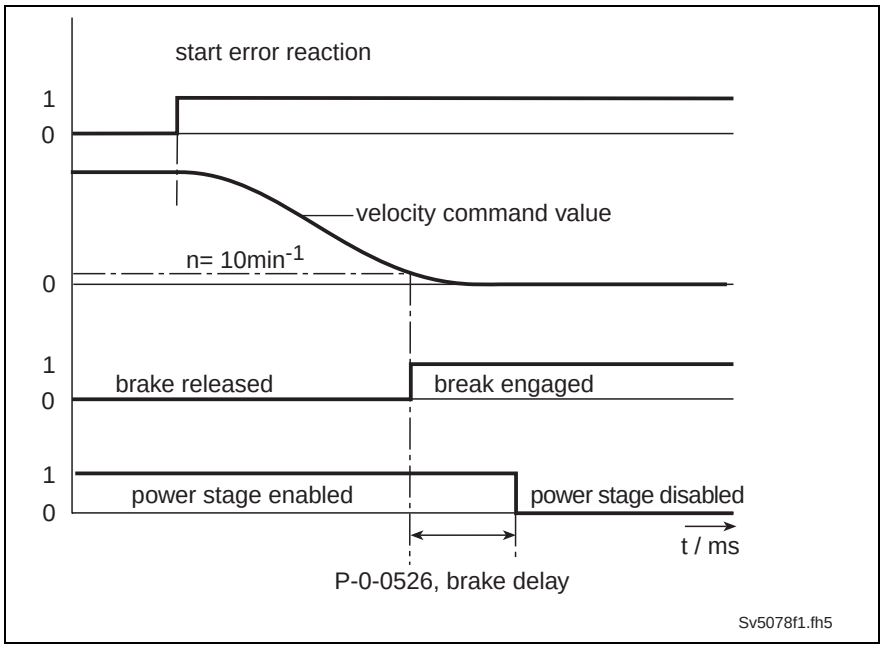


Fig. 9-18: Evaluation of probe signal edges, when positive and negative signal edge evaluation are set in the probe control parameter

Results of Writing "3" to the S-0-0170, Probing Cycle Procedure Command

The probe feature begins when 3 (decimal) = 11 binary is written into the parameter **S-0-0170, Probing cycle procedure command**. The following will happen:

- The **data status** will be set to **7** by **S-0-0170, Probing cycle procedure command**.
- All probe values and probe value differences will be set to 0.
- All "probe ... latched“ parameters will be cancelled.
- The external voltage monitor will be activated (if it has not yet been activated).

Signal Edge Selection for the Probe Inputs

A positive probe value and a negative probe value are available for every probe input. The positive probe value is assigned the 0→1 (rising) edge of the probe signal, and the negative probe value is assigned the 1→0 (falling) edge. The **S-0-0169, Probe control parameter** determines whether both occurring edges will be evaluated and will lead to the positive/negative probe values being saved.

The parameter should be set before activating this feature.

parameter structure:

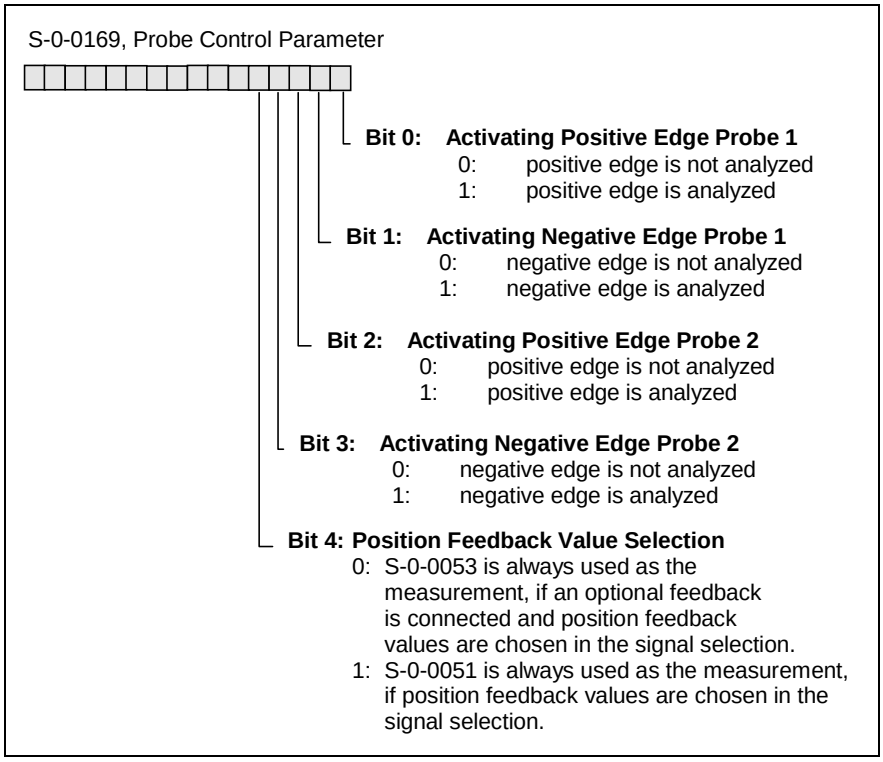

S-0-0169, Probe Control Parameter
Bit 0: Activating Positive Edge Probe 1
0: positive edge is not analyzed
1: positive edge is analyzed
Bit 1: Activating Negative Edge Probe 1
0: negative edge is not analyzed
1: negative edge is analyzed
Bit 2: Activating Positive Edge Probe 2
0: positive edge is not analyzed
1: positive edge is analyzed
Bit 3: Activating Negative Edge Probe 2
0: negative edge is not analyzed
1: negative edge is analyzed
Bit 4: Position Feedback Value Selection
0: S-0-0053 is always used as the measurement, if an optional feedback is connected and position feedback values are chosen in the signal selection.
1: S-0-0051 is always used as the measurement, if position feedback values are chosen in the signal selection.

Fig. 9-19: Structure of Parameter S-0-0169, Probe Control

Signal Selection for the Probe Inputs

Values to be measured are:

- actual position value 1 (motor encoder)
- actual position value 2 (optional encoder, if mounted)
- internal time

The choice is made via parameters

- **P-0-0200, Signal select probe 1**
- **P-0-0201, Signal select probe 2**
- as well as in bit 4 of **S-0-0169, Probe control** parameter.

Using P-0-0200 or P-0-0201 it is possible to determine for both probe inputs whether an actual position value or an internal time is to be measured.

Value of P-0-0200/201:	Signal:
0	actual position value 1/2
1	time

Fig. 9-20: Probe function determining signals

Depending on this choice, the units, decimal places of parameter measured value positive and negative, Measured value difference, Start position probe function active and End position probe function active of the relevant probe are switched.

If the actual position value is selected in the signal select parameters, then bit 4 in **S-0-0169, Probe control parameter** decides whether **S-0-0051, Position feedback 1 value** or **S-0-0053, Position feedback 2 value** will be used as signal.

Connecting the Probe Inputs

see project planning manual

The following levels are valid for the probe inputs:

Low: 0..+6V

High: +14V..U_{ext}(max)

The inputs need an external power supply (with voltage U_{ext}) because they are electrically isolated.

The following applies:

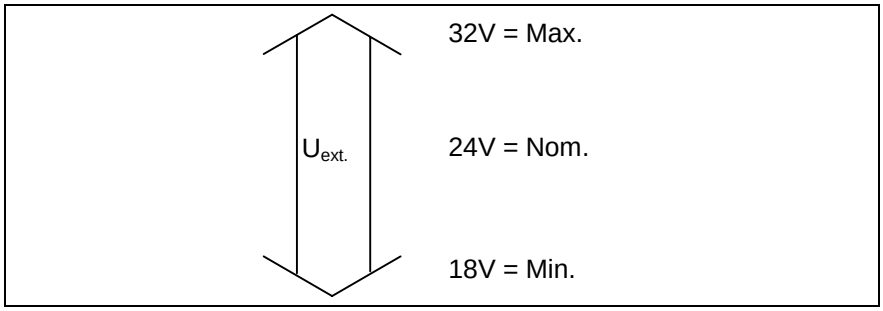


Fig. 9-21:Permissible input voltage range of the external power supply

If the external voltage is not in this range, then the error message **F272 Error power supply probe input** will be generated.

9.7 Command - detect marker position

The command "Detect marker position" supports

- the control of a faultless detection of the reference marker in an incremental measuring system or
- determining the position of the reference marker if the referencing procedure is conducted by the control. In this case, this information is used to switch the coordinate system in the control.

A reference switching evaluation is not run with this command.

The following parameters are provided for this function:

- **S-0-0173, Marker position A**
- **P-0-0014, D500 Command determine marker position**

Functional principle of command detect marker position

Once the command **P-0-0014, D500 Command determine marker position** is activated, the following is done:

- The diagnosis **D500 detect marker position command** is generated.
- If an incremental measuring system is selected, then the detection of a reference marker is activated, and the drive waits for the next reference marker.
- If a reference marker is detected, i.e., the position of a reference marker has been runover, then its position feedback value is stored in parameter **S-0-0173, Marker position A.** This command is now signalled as completed.

Note: The drive generates no command values. The mode active at command start remains unchanged. To override the reference marker, the control must generate command values (e.g., by jogging), that cause a motion in the direction in which the reference markers are to be detected.

Additional uses of parameter "S-0-0173, Marker position A

"In parameter **S-0-0173, Marker position A**, the position of the reference marker is also stored during the command **S-0-0148, C600 Drive controlled homing procedure command**. This relates, however, to the "old" coordinate system (before the coordinate system was switched while performing a homing function).

9.8 Command Parking Axis

The command "Parking Axis" supports the operational decoupling of an axis. This may, for example, be necessary if an axis is temporarily brought to a standstill. The start of the command switches off all monitoring functions of the measuring system and the control loops.

The following parameter is available for this function:

- **S-0-0139, D700 Command parking axis**

The functional principle of the command parking axis

Command can only be executed in parameter mode

The command can only be started in parameter mode (communications phases 2 or 3). Once **S-0-0139, D700 command parking axis** is started, the:

- The measuring system monitors ,
- the control loop monitors and
- the temperature monitors

are deactivated.

The measuring system initializations are not executed in command **S-0-0128, C200 communications phase 4 transition check**. "**PA**" appears at the 7-segment display. The drive no longer accepts the drive enable signal.

All active commands in the drive are cancelled when switching the communications phases back. If this command was activated, followed by a progression into communications phase 4 (operating mode), then there is no need to cancel the command, as the cancelling is only possible in communications phases 2 or 3, and any phase regression will also inevitably cancel all commands.

9.9 Programmable Limit Switch

The "Programmable Limit Switch" feature allows for 16 PLS points. An individual on- and off-switch position and a delay time are available for each PLS point.

The reference signal for the PLS can be selected

The reference signal can be either

S-0-0051, Position feedback 1 value or

S-0-0053, Position feedback 2 value.

The corresponding PLS bit can be inverted depending on how the on- and off-switch level is set.

Note: A switch cam is generated every 1 ms resulting in a total cycle time of 16 ms when parametrizing all 16 cams.

Pertinent Parameters

- **P-0-0131, Signal Select Position Switch**
- **P-0-0132, Switch-On Treshold Position Switch**
- **P-0-0133, Switch Off-Treshold Position Switch**
- **P-0-0134, Position Switch Lead Time**
- **P-0-0135, Status Position Switch**

Function diagram for the Programmable Limit Switch

This feature shows whether the selected reference signal lies within the range between the on- and off-switch position.

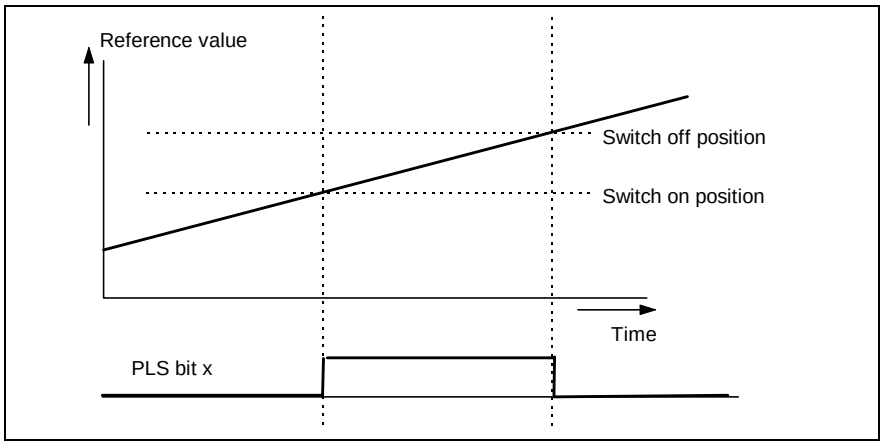


Fig. 9-22: General Function Diagram for the Programmable Limit Switch

Inverting occurs by exchanging the on- and off-switch level

The corresponding bit in the status position switch can be inverted by setting the on- and off-switch level.

There are two different situations that apply.

Switch-on position smaller than the switch-off position

If the switch-on position is programmed smaller than the switch-off position, then the following applies:

The position switch is "1" if:

- Reference signal > Xon
  AND
- Reference signal < Xoff

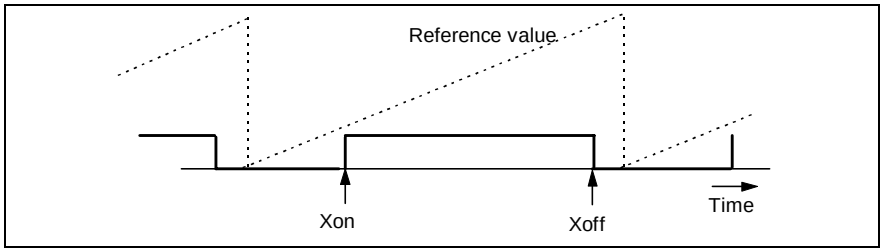


Fig. 9-23: Programmable Limit Switch with Xon < Xoff

Switch-on Position larger than the switch-off Position

The programmable limit switch is "1" if the following applies:

- Reference signal > Xon
  OR
- Reference signal < Xoff

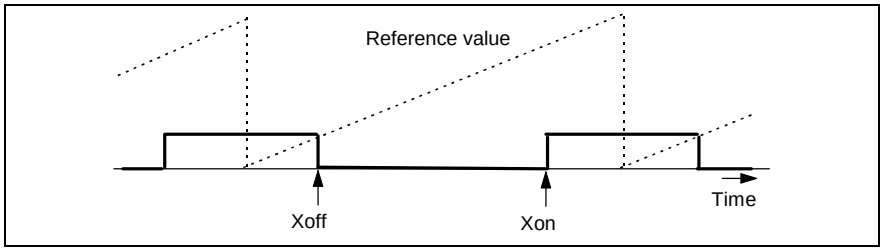


Fig. 9-24: Programmable Limit Switch With Xon > Xoff

A switch hysteresis is available to avoid position-switch flickering when the on- or off-switch level is reached.

Programmable Limit Switch Lead Time

The velocity of the drive should remain constant while using the lead time.

By setting a lead time, compensation can be made for the delay of an external switch element that is controlled by a PLS bit. In that way, a theoretical adjustment value can be calculated from the lead time and the current drive velocity for the on- and off-switch positions. The PLS bit switches by the lead time before reaching the corresponding position.

The assumption is that velocity is constant in the range between the theoretical and real on- or off-switch position.

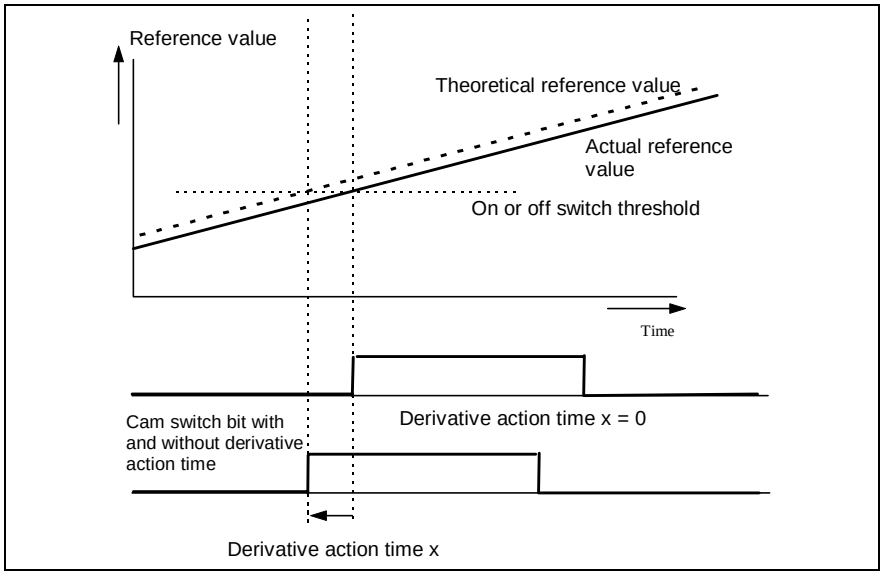

Reference value
Theoretical reference value
Actual reference value
On or off switch threshold
Time
Cam switch bit with and without derivative action time
Derivative action time x = 0
Derivative action time x

Fig. 9-25: Diagram for the Programmable Limit Switch Lead Time

Parameterizing the Programmable Limit Switch

The **P-0-0131, Signal Selection for Programmable Limit Switch** parameter is used to activate the programmable limit switch and to select a signal. The following values can be entered:

P-0-0131:	Feature:
0	The programmable limitswitch is not activated.
1	The programmable limit switch is activated; the reference signal is S-0-0051, Position feedback 1 value.
2	The programmable limit switch is activated; the reference signal is S-0-0053, Position feedback 2 value.

Fig. 9-26: Programmable Limit Switch: Activation and Setting the Reference Signal

The P-0-0134 Programmable Limit Switch Lead Time parameter always should be parameterized completely (i.e., with all 16 elements), even if not using the delay..

The programmable limit switch parameters P-0-0132, Switch-On position, P-0-0133, Switch-Off position and P-0-0134, Lead Time can be used to set the on- and off-switch thresholds as well as the lead time.

Each of these parameters contains 16 elements. Element 1 is assigned for position switch bit 1, element 2 for bit 2, and so forth.

If one or more switch bits are not given a delay, then "0" should be set for these elements in **P-0-0134, Programmable Limit Switch Lead Time**.

The status of the position switch bits are shown in parameter **P-0-0135, Status Position Switch**.

9.10 Encoder Emulation

It is possible, with the help of encoder emulation to generate positions in the following standard formats

- **TTL format** with incremental encoder emulation
- **SSI format** with absolute encoder emulation.

This makes it possible to close the position control loop with an external control.

Incremental encoder emulation

Incremental encoder emulation is the reproduction of a real incremental encoder by a driver controller.

From the emulated incremental encoder signal, signals are relayed via a higher-ranking numeric control (NC) with information about the velocity of the motor mounted to the controller. By integrating this signal, the control generates information for itself about position. It is thus able to close a higher-ranking position control loop.

Absolute encoder emulation

"Absolute encoder emulation" means that the drive controller has the option of emulating a real absolute encoder in **SSI data format**. The drive controller thus offers the possibility of transmitting the position in SSI data format to the connected control (NC). Thus the control is able to close the position control loop.

Pertinent Parameters

- **P-0-4020, Encoder emulation type**
- **P-0-0502, Encoder emulation, resolution**
- **P-0-0012, C300 Command 'Set absolute measurement'**

Parameter

- **P-0-0503, Marker pulse offset**

is used for **incremental encoder emulation.**

Parameter

- **S-0-0052, Reference distance 1**

is used for **absolute encoder emulation.**

Activating Encoder Emulation

It is possible to control the behavior of the function with the help of parameter **P-0-4020, Encoder emulation type.**

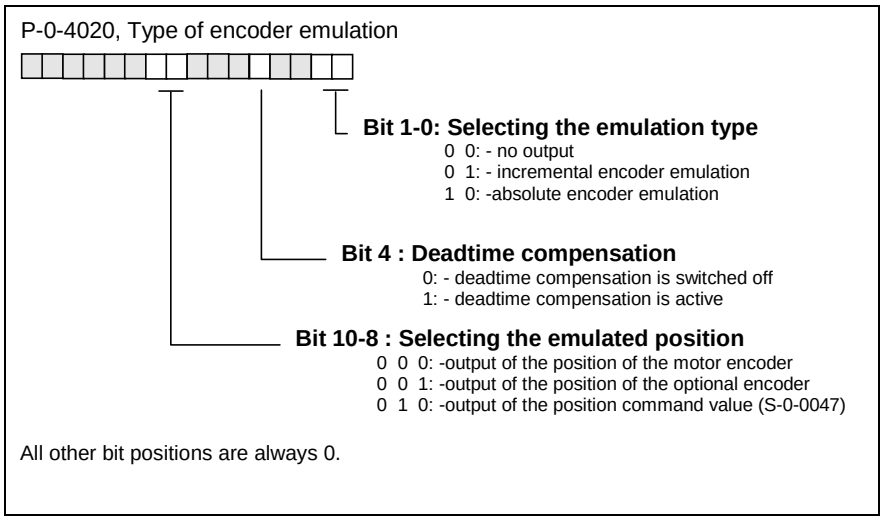

P-0-4020, Type of encoder emulation
Bit 1-0: Selecting the emulation type
0 0: - no output
0 1: - incremental encoder emulation
1 0: -absolute encoder emulation
Bit 4 : Deadtime compensation
0: - deadtime compensation is switched off
1: - deadtime compensation is active
Bit 10-8 : Selecting the emulated position
0 0 0: -output of the position of the motor encoder
0 0 1: -output of the position of the optional encoder
0 1 0: -output of the position command value (S-0-0047)
All other bit positions are always 0.

Fig. 9-27: Parameter encoder emulation type P-0-4020

Functional principle: Incremental Encoder Emulation

Number of lines

The **number of lines** of the emulated incremental encoder is fixed in parameter **P-0-0502, Encoder emulation, resolution**:

- **1 to 65536 (=2^16) lines / revolution**

Note: If a motor with resolver feedback is mounted, then the emulator generates as many zero pulses per revolution as the resolver has pairs of poles. It must therefore be noted that the input for **P-0-0502**, **Encoder emulation, resolution** must be divisible by the number of resolver pole pairs without a remainder, otherwise the zero pulse will "run away".

Unit

The parameter unit depends on the motor type, i.e.,

- rotary motors: lines / revolution
- linear motors: lines / mm or lines / inch

Position of the Zero Pulse as Relates to Motor Position

Absolute encoder

With motor encoders that achieve an absolute position within one motor revolution after initialization, or within one electrical revolution with resolvers, the zero pulse is always generated at the same motor position each time the unit is switched on.

Non-absolut encoder

Non-absolut encoders do not have an automatic method of determining position after powering up. This is why it is necessary to home. Homing uses the incremental encoder emulator zero pulse.

With non-absolut encoders, e.g., sine, gearwheel encoders, the following occurs automatically with each progression of phases 2 to 4 (in other words after each powering up of the drive controller):

- The detection of the motor encoder internal reference point is activated.
- The zero pulse output of the incremental encoder emulator is locked.
- The increment output is activated.

It is assumed that the motor can now be run via the position control loop by the control (homing, going to zero or referencing).

Drive-guided referencing

The drive can also conduct drive-guided referencing if the control permits it.

As soon as the motor encoder internal reference point is detected, the following is conducted:

- general release of zero pulse output
- immediate output of a zero pulse by the emulator
- initialization of zero pulse so that it is always output at this absolute motor position.

Note: The output of the zero pulse occurs after referencing is successfully completed. It is output at the same position, however, (reference marker).

Zero pulse offset

With **rotary motors** it is possible to offset the zero pulse using **P-0-0503**, **Marker pulse offset** within a (electrical or mechanical) rotation in a clockwise direction.

The **unit** of P-0-0503 is **degrees.** The input range for motor encoders that are absolute after their initialization with unequivoal positions within a **motor revolution** of **0..359.9999 degrees.**

The input range for **resolvers** with an absolute, unequivocal position within an **electrical revolution** is

0 ... 359.9999 degrees /number of pole pairs.

Limiting Incremental Encoder Emulation

In contrast to the conventional incremental encoder with which the pulse output frequency is practically infinitely seperated into very fine increments (i.e., the pulses are allocated to a fixed position), emulated incremental encoder signals are subject to certain restrictions. These are primarily the result of how the digital process of the drive controller works.

Maximum output frequency

The maximum pulse frequency for devices is 1024 kHz. If this frequency is exceeded, then pulses could be lost. The non-fatal error **F253 Incr. encoder emulator: pulse frequency too high** is generated. A position offset of the emulated position in contrast to the real position takes place.

$$l_{max} = \frac{f_{max} * 60}{n_{max}}$$

l_{max}: maximum line number
n_{max}: allowable maximum speed in 1/min

Fig. 9-28: Computing the maximum number of lines

Compensation of delay (deadtime) between real and emulated positions

Between position measurement and pulse output, there is a dead time (delay) of about 1ms in devices. If in parameter **P-0-4020, Encoder emulation type** bit 4 is set to 1, then this time is compensated in the drive.

Pulse breaks at the end of the pulse output cycle

At the end of each time interval the **signal level** for a specific period can **remain constant**. The output frequency may not be changed during the time interval of T_A. This is especially true of high frequencies, i.e., with a large number of lines and/or at high speeds.

Diagnostic Messages with Incremental Encoder Emulation

The following diagnoses are generated with incremental encoder emulation:

- **F253 Incr. encoder emulator: pulse frequency too high**

Cause:

The output frequency at the chosen number of lines exceeds the value of 1024 kHz.

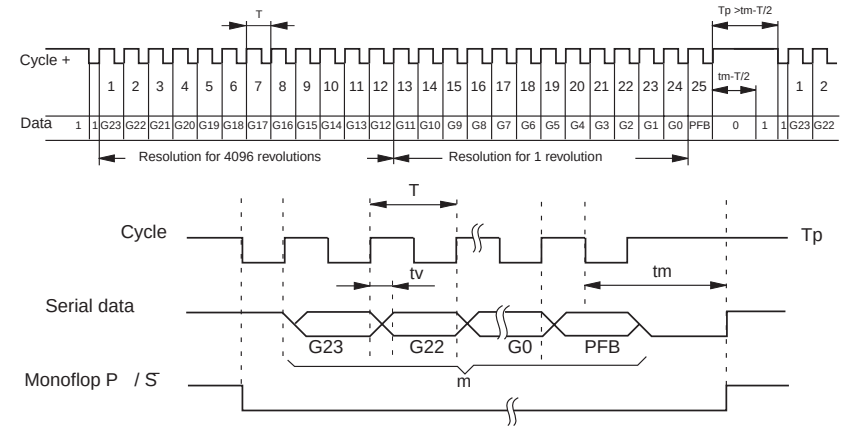
Remedy:

- Decrease input for **P-0-0502, Encoder emulation, resolution**
- Drop travel speed

Functional Principle: Absolute Encoder Emulation

SSI Format

The following illustrates the format of SSI data transmission.


T
Tp >tm-T/2
Cycle +
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
tm-T/2
1 2
Data
1 1 G23 G22 G21 G20 G19 G18 G17 G16 G15 G14 G13 G12 G11 G10 G9 G8 G7 G6 G5 G4 G3 G2 G1 G0 PFB 0 1 1 G23 G22
Resolution for 4096 revolutions
Resolution for 1 revolution
T
Cycle
Tp
tv
tm
Serial data
G23
G22
G0
PFB
Monoflop P / S
m

G0 = lowest value bit in the Gray-Code
G23 = highest value bit in the Gray-Code
m = saved parallel information
T = cycle signal period duration
tm = monoflop time 15µs to 25µs
Tp = cycle rest
tv = delay time for the first cycle max. 540ns, for all others max. 360ns
PFB = Power Failure Bit (is not used and is logically always... "0")

ap5002d1.fh7

Fig. 9-29: SSI format as pulse diagram

Note: The Power Failure Bit is not evaluated in the drive!

Resolution with Absolute Encoder Emulation

The output data format (number of bits/revolution) for the emulated SSI position is fixed in parameter **P-0-0502**, **Encoder emulation, resolution**.

The input range and unit depends on **S-0-0076, Position data scaling type.** The following combinations are possible:

- 12 .. 24 bit / revolution
- 4 .. 24 bit / mm
- 8 .. 24 bit / inch.

The output direction is set in parameter **S-0-0055, Position polarities**.

Note: The unit of the parameter is switched when selecting SSI emulation via parameter **P-0-4020, Encoder emulation type.**

Referencing with Absolute Encoder Emulation

Using parameter **P-0-0012, C300 Command 'Set absolute measurement'** it is posible to reference the absolute position output by the absolute encoder emulator .

With set absolute dimension, the value of parameter S-0-0052 Reference distance 1 is set.

Position jumps at the Display Limits of Absolute Encoder Emulation

Using SSI emulation, it is possible to illustrate 4096 revolutions absolutely. If when using SSI emulation the limit has been reached, then small position fluctuations lead to large **jumps in the emulated SSI position**.

This is the case with position 0 and 4096 revolutions.

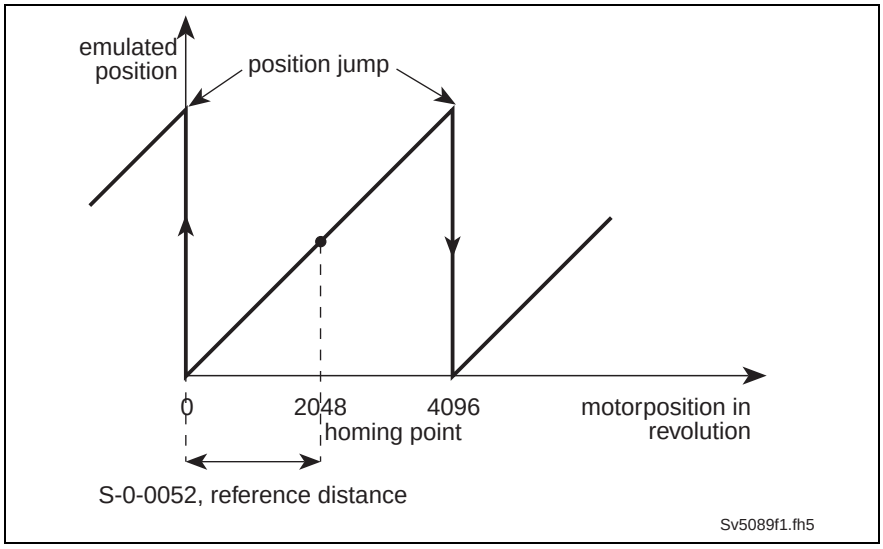


Fig. 9-30: SSI display limits

To avoid this, then use commando **P-0-0012, C300 Command 'Set absolute measurement'** to shift the SSI position value.

It is recommended to move the position into the center of the SSI display range by means of the **S-0-0052, Reference distance 1**. This offers the option of running 2048 revolutions to the left and to the right.

9.11 Measuring wheel operation mode

Roll feed drives move material that is being machined or processsed further down the line (e.g., the cutting of tin). The motor encoder, in this case, is not suited for measuring material lengths if lag occurs between the material and the drive. In cases such as these, it is possible to use an external encoder, a measuring wheel encoder. Ideally, there is no slip between machine and material so that sections of length can be precisely measured.

CAUTION

If the measuring wheel encoder no longer has contact to the material

then the position control loop is open via encoder 2 and the drive can move uncontrolled.

⇒ Only start up measuring wheel mode if encoder 2 is connected to the material.

Pertinent Parameters

- **P-0-0185, Function of encoder 2**
- **P-0-0220, D800 Command Measuring wheel operation mode**
- **P-0-0221, Actual position filter time const. for measuring wheel mode**

How it Works

Pre-requisite

- The optional encoder must be registered as a measuring wheel encoder in parameter **P-0-0185, Function of encoder 2**.
- Material must be in the feed roll and under the measuring wheel.
- The feed roll must be closed.
- The measuring wheel encoder is pressed against the material.

Activation

The function is activated with command **P-0-0220, D800 Command Measuring wheel operation mode**.

At the start of the command, the drive sets actual position value 2 (measuring wheel encoder) to actual position value 1.

The active mode determines all further behavior of the drive.

Drive in position control

The drive switches to position control with encoders 1 and 2.

Note: The absolute positon of the encoder is not relevant as the position of the encoder is always re-initialized.

Negative effects resulting from poor coupling of encoder 2 to the motor shaft (only with material) should be modified by attenuating the actual position value difference. Filter 1 smooths the difference. The filter time constant is set in parameter **P-0-0221, Actual position filter time const. for measuring wheel mode**.

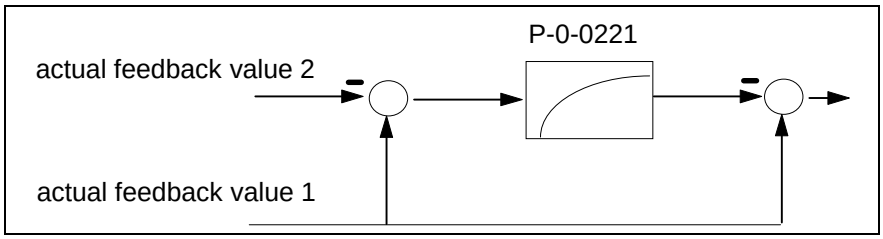


Fig. 9-31: Generating the actual position value in measuring wheel mode

Drive not in position control

The measuring wheel encoder position is correctly detected. It is controlled, however, with encoder 1.

Clearing the command

Position control using the measuring wheel encoder remains active until the command is set.

When clearing the command, the drive sets the actual position value 1 to actual position value 2 and goes back to position control with encoder 1.

Note: The measuring encoder evaluation also remains active if:

the operating mode is switched with active command
with an error
with drive halt active
or if the drive enable is removed

Parametrizing the measuring wheel encoder

A measuring wheel encoder is parametrized using parameters:

- **S-0-0123, Feed constant**
- **S-0-0115, Position feedback 2 type**
- **S-0-0117, Feedback 2 Resolution**

Diagnostic Messages

In conjunction with measuring wheel mode command, the following error message can be generated:

- **D801 Measuring wheel operation not possible**

Notes

10 Glossary

Data status

Every parameter has at its disposal a data status. It can be read by the control via the required data channel. The information on the validity of the parameter or the command acknowledgment of the command are contained therein.

Error reaction or response

If an error is detected in the drive, then the drive reacts independently by executing an error reaction. At the end of each error reaction there is a deactivation of the drive. The error reaction type is dependent on the error class of the error that occurred as well as the setting in parameters P-0-0117..119.

E-Stop

E-Stop (Emergency Stop) is the determination for a hardware input at the drive controller. It is used to trigger the emergency stop function in the drive.

External encoder

An external measuring system is optional. It is generally mounted directly to the load. The actual feedback value of the encoder can be seen in S-0-0053, Actual feedback value 2. By activating the position control operating mode with encoder 2, the position control loop is closed with the help of the actual feedback value of the external encoder.

Ident Number

Every parameter is designated unambiguously by its ident number (IDN). It consists of these 3 components: S-Sercos/P-Product specific, parameter set (0..7) and a number (1..4096).

Load default or basic load

The control parameters are stored in the motor feedback data memory in both MDD and MKD motors. This makes it possible for the drive controller to work trouble-free with this motor. The control parameters have not been optimized for the application.

Modulo format

Both actual feedback and command values can be processed in modulo or absolute format. If modulo processing has been set, then the position data move within the range of 0..S-0-0103, modulo value. With this function, it is possible to realize an endlessly turning axis.

Motor encoder

The motor encoder is the measuring system that is used during commutation. A measuring system is absolutely necessary. The actual feedback value of the encoder can be seen in S-0-0051, Actual position value 1. By activating the position control operating mode with encoder 1, the position control loop is closed with the help of the actual position of the motor encoder.

Operating data

The operating data is data block element 7 of a parameter. The value of the parameter is stored there.

Operating mode

Operating mode is set in parameters S-0-0032..35. It determines in what way a command value is processed in the drive and eventually initiates an axis movement. The operating mode does not define how the command value reaches the drive.

Parameterization mode

The drive is in parameterization mode if communication phases 1..3 have been set. The drive cannot be activated (drive enable signal applied). Operating mode must first be switched into. Some parameters can only be written into during parameterization mode.

Programming module

The programming module contains the software and parameter memory. It is mounted in slot U5. When exchanging the controller, a simple insertion of the programming module out of the old into the new unit means that the features of the replaced unit have been transferred to the new one.

Reference Switch

If during the command **S-0-0148, C600 Drive controlled homing** several reference marks can be reached within the travel range, it's the reference switch which must specify one singular mark. The reference switch is connected to the respective input at the drive and activated by bit 5 in S-0-0147, Homing Parameter. This input is mirrored in the parameter **S-0-0400, Home switch**.

Scaling

The combination of unit and number of decimal places of a parameter are defined as scaling. It can be set for position, velocity and acceleration data.

Service Channel

The non-cyclic reading and writing of parameters via the SERCOS-Interface is done in the service channel

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0

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ECODRIVE03
Drive for General Automation
with Fieldbus-Interfaces

Supplement A
Parameter Description
FGP 02VRS

DOK-ECODR3-FGP-02VRS**-FKB1-EN-P

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1 General Information

Using This Manual

All standard and product specific parameters are listed in this chapter in a numerically ascending order.

This chapter supplements the feature description and represents a complete description of all parameters used in the Ecodrive software. The description of the individual parameters is divided into two subsections.

1) General description
This section contains the feature or meaning of the parameter and tips for setting parameters.

2) Description of attributes

The characteristic values or features listed here help to classify the parameter. They are necessary for a complete description of the parameter. However, they are not required to get a general idea of the meaning of the parameter.

Definitions

The following abbreviations are used:

Data length:

2-byte - the data length for the operating data is 2 bytes.

4-byte - the data length for the operating data is 4 bytes.

1-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 1 byte.

2-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 2 bytes.

4-byte variable - this is a piece of operating data of variable length (list). The length of a data unit is 4 bytes.

Format:

BIN - the display format for the operating data should be binary.

HEX - the display format for the operating data should be hexadecimal.

DEC_OV - The display format for the operating data should be decimal without a sign.

DEC_MV - The display format for the operating data should be decimal with a sign.

ASCII - the operating data is an ASCII string.

IDN - the operating data is an ID number (IDN).

Editability:

No - the operating data cannot be edited.

P2 - The operating data can only be edited in communications phase 2.

P23 - The operating data can only be edited in communications phases 2 and 3.

P234 - The operating data can be edited in any communications phase.

P3 - The operating data can only be edited in communications phase 3.

P4 - The operating data can only be edited in communications phase 4.

Memory:

fixed - the operating data is programmed in the drive (fixed value).

no - The operating data is not buffered in the drive; the value is undefined after the drive controller is switched on.

Param. EE - The operating data is buffered in E²prom of the programming module (DSM).

Ampl. EE - The operating data is buffered in E²prom of the drive controller.

Feedb. EE - The operating data is buffered in the E²prom of the motor feedback data memory (only in MHD- and MKD motors).

Validity check:

no - the operating data is not checked for validity.

Phase2 - the operating data is checked in the "Communications phase 3 transition check" command.

Phase3 - the operating data is checked in the "Communications phase 4 transition check" command.

Extreme value check:

no - the operating data is not checked for its extreme values when it is written to.

yes - the operating data is checked for its extreme values when it is written to.

Combination check:

no - the operating data is not checked (bitwise) for a valid combination with other parameter values when it is written to.

yes - The operating data is checked (bitwise) for a valid combination with other parameter values when it is written to.

Cyc. transmittable:

no - The operating data cannot be configured as cyclical data in the master data telegram or in the drive telegram.

AT - The operating data can be configured as cyclical data in the drive telegram.

MDT - The operating data can be configured as cyclical data in the master data telegram.

Default Value:

The default value indicates the value of the parameter loaded into fixed memory with the current version of firmware installed on the drive following the PL program load command and prior to user edits or loading saved parameter files.

Notes

2 Standard Parameters

S-0-0001, NC Cycle time (TNcyc)

The NC cycle time indicates the time intervals between new command values being made available by the numerical control.

The NC cycle time must be an integral multiple of **S-0-0002, SERCOS Cycle time (Tscyc)**.

$$T_{Ncyc} = T_{Scyc} \cdot j, \quad \text{where } j = 1,2,3...$$

S-0-0001 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase2
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	2000 / 65000		
Default value:	2000	**Cyc. transmittable:**	no

S-0-0002, SERCOS Cycle time (Tscyc)

The interface cycle time indicates the time intervals for the cyclical data transfer. The interface cycle times are set to

2 ms, ... to 65 ms in increments of 1ms.

S-0-0002 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase2
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	2000 / 65000		
Default value:	2000	**Cyc. transmittable:**	no

S-0-0005, Minimum feedback acquisition time(T4min)

This is the minimum time requirement between feedback-value acquisition and the end of the master synchronization telegram. This value is indicated by the drive in such a manner that the current feedback values can be transmitted to the numerical control in the next drive telegram.

S-0-0005 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	constant
Format:	DEC_OV	**Validity check:**	no
Unit:	us	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0007, Feedback acquisition starting time (T4)

This is the feedback acquisition starting time set by the master after the end of the master synchronization telegram. Thus, the master can set the same feedback acquisition starting time for all drives that work together. This guarantees synchronized feedback-value acquisition among the affected drives. Also, the cyclically transferred command values are processed at time T4.

S-0-0007 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase2
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	11 / 65000		
Default value:	1500	**Cyc. transmittable:**	no

S-0-0008, Command valid time (T3)

The "command valid time" indicates the time after which the drive may access new command values.

Thus, the master can set the same "command valid time" for all drives that work together. The drive activates the "command valid time" beginning with communications phase 3.

S-0-0008 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase2
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 65000		
Default value:	1000	**Cyc. transmittable:**	no

S-0-0011, Class 1 diagnostics

Function: Drive lock

A Class 1 diagnostic error situation discovered by the drive leads to

- the drive's error response, as described in the functional description under "Error".
- setting the static error bits to 1 for Class 1 (**S-0-0135, Drive status word**)

The drive resets the error bit back to 0 only if

- there are no errors pending in C1D
- and command **S-0-0099, C500 Reset C1D** has been started.

Parameter structure:

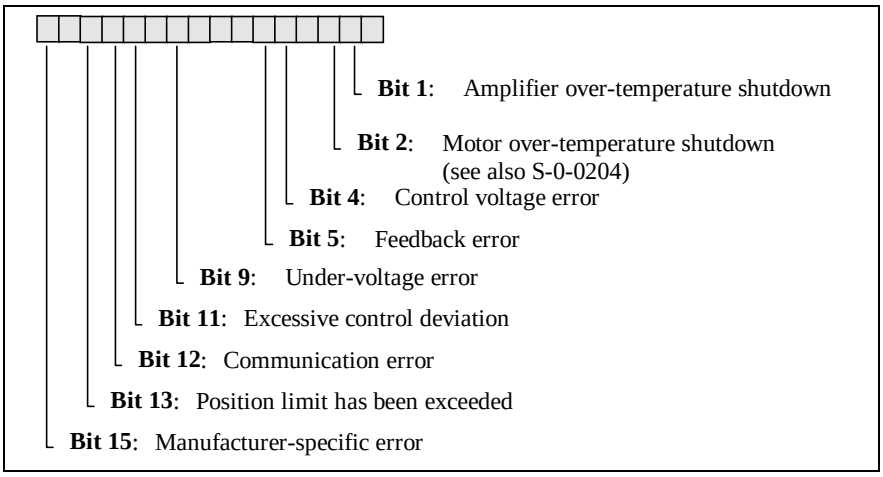

Bit 1: Amplifier over-temperature shutdown
Bit 2: Motor over-temperature shutdown (see also S-0-0204)
Bit 4: Control voltage error
Bit 5: Feedback error
Bit 9: Under-voltage error
Bit 11: Excessive control deviation
Bit 12: Communication error
Bit 13: Position limit has been exceeded
Bit 15: Manufacturer-specific error

Fig. 2-1: S-0-0011, Class 1 diagnostics

See also the functional description: "S-0-0011, Class 1 diagnostics".

S-0-0011 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0012, Class 2 diagnostics

Function: Shutdown warning.

If a C2D warning is pending in the drive, i.e., is active or inactive, then the change bit (S-0-0135, **Drive status word** Bit 12) for the C2D is set.

The change bit (S-0-0135, **Drive status word** Bit 12) is not cleared by the drive until parameter S-0-0012, **Class 2 diagnostics** has been read.

Parameter structure:

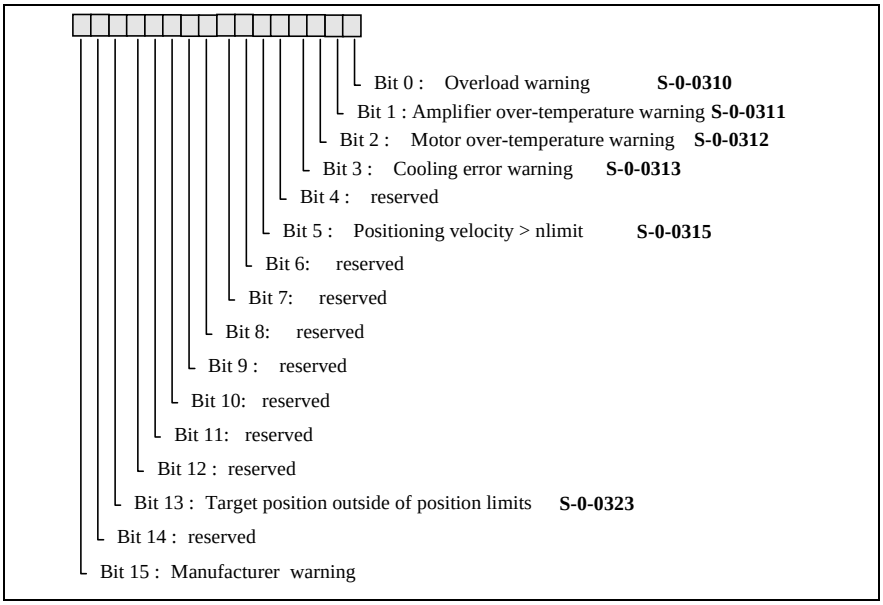

Bit 0 : Overload warning S-0-0310
Bit 1 : Amplifier over-temperature warning S-0-0311
Bit 2 : Motor over-temperature warning S-0-0312
Bit 3 : Cooling error warning S-0-0313
Bit 4 : reserved
Bit 5 : Positioning velocity > nlimit S-0-0315
Bit 6: reserved
Bit 7: reserved
Bit 8: reserved
Bit 9 : reserved
Bit 10: reserved
Bit 11: reserved
Bit 12 : reserved
Bit 13 : Target position outside of position limits S-0-0323
Bit 14 : reserved
Bit 15 : Manufacturer warning

Fig. 2-2: S-0-0012, Class 2 diagnostics

S-0-0012 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0013, Class 3 diagnostics

Function: Operating status messages.

If a C3D message is active or inactive in the drive, then the change bit (S-0-0135, **Drive status word** Bit 11) is set in the drive.

The change bit (S-0-0135, **Drive status word** Bit 11) is not reset by the drive until parameter S-0-0013, **Class 3 diagnostics** is read.

Parameter structure:

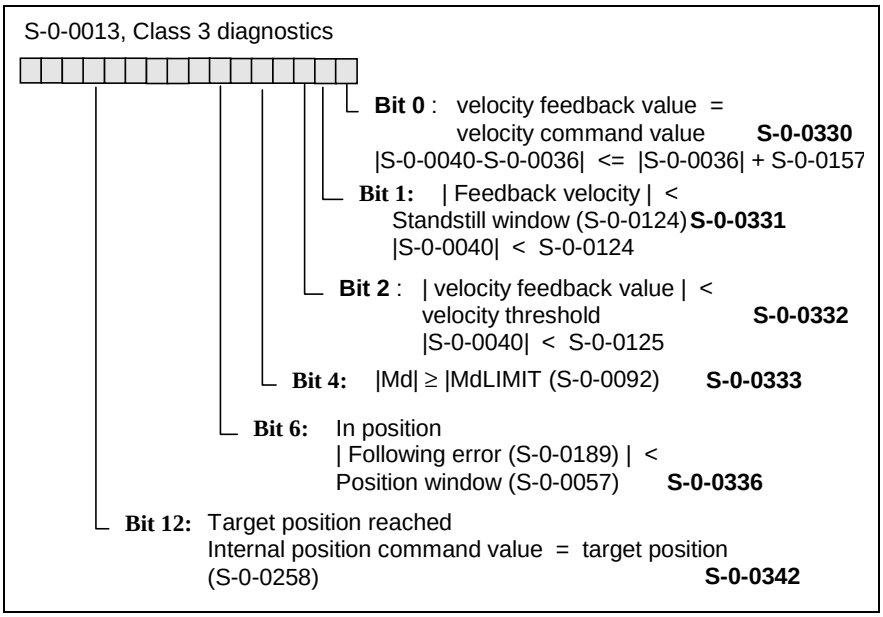

S-0-0013, Class 3 diagnostics
Bit 0 : velocity feedback value = velocity command value S-0-0330
|S-0-0040-S-0-0036| <= |S-0-0036| + S-0-0157
Bit 1: | Feedback velocity | < Standstill window (S-0-0124) S-0-0331
|S-0-0040| < S-0-0124
Bit 2 : | velocity feedback value | < velocity threshold S-0-0332
|S-0-0040| < S-0-0125
Bit 4: |Md| ≥ |MdLIMIT (S-0-0092) S-0-0333
Bit 6: In position
| Following error (S-0-0189) | < Position window (S-0-0057) S-0-0336
Bit 12: Target position reached
Internal position command value = target position (S-0-0258) S-0-0342

Fig. 2-3: S-0-0013, Class 3 Diagnostics

See also the functional description: "S-0-0013, Class 3 diagnostics".

S-0-0013 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0014, Interface status

In the least significant three bits (0, 1, 2), the current communication phase can be requested:

0010b: The drive is in **parametrization mode.**

0100b: The drive is in **operation mode**.

If an interface error occurs, then

- one of the **bits 4 to 15** in **S-0-0014, Interface status** is set (bit in 4 to 15 = 1 => error pending)
- and **bit 12** in **S-0-0011, Class 1 diagnostics** is set.

The communications error bits are not cleared by the drive until

- the relevant interface error is no longer pending
- and command **S-0-0099, C500 Reset class 1 diagnostic** was started.

Parameter structure:

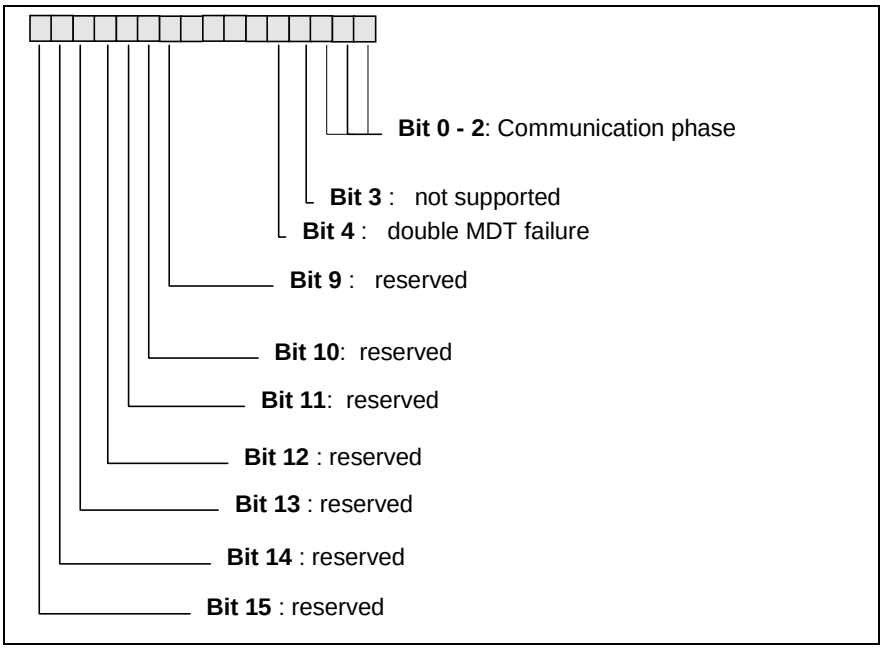

Bit 0 - 2: Communication phase
Bit 3 : not supported
Bit 4 : double MDT failure
Bit 9 : reserved
Bit 10: reserved
Bit 11: reserved
Bit 12 : reserved
Bit 13 : reserved
Bit 14 : reserved
Bit 15 : reserved

Fig. 2-4: S-0-0014, Interface status

S-0-0014 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0016, Custom amplifier telegram configuration list

Note: The parameter supports the internal exchange of data between the drive and the communications processor.

The list can contain only operating data that are listed in the parameter **S-0-0187, List of configurable data in the AT**.

S-0-0016 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte var.	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	Phase2
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0017, IDN-list of all operation data

The ID numbers for all parameters with operation data available in the drive are accessible in this IDN list.

See also the functional description: "Parameter"

S-0-0017 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0018, IDN-list of operation data for CP2

The the IDN-list contains the ident-numbers of all parameters that the drive checks in the transition command for phase 3. Only when the data of the listed ident-numbers are correct, the transition command can be acquitted positive, and the transition to communications phase 3 can be allowed.

See also the functional description: "IDN List of Parameters"

S-0-0018 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0019, IDN-list of operation data for CP3

The the IDN-list contains the ident-numbers of all parameters that the drive checks in the transition command for phase 4. Only when the data of the listed ident-numbers are correct, the transition command can be acquitted positive, and the transition to communications phase 4 can be allowed.

S-0-0019 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0021, IDN-list of invalid op. data for comm. Ph. 2

The drive checks whether all communications parameters are complete and correct before executing a delayed phase switch from 2 to **S-0-0127, C100 Communication phase 3 transition check** with the control system-driven transition check command.

If the drive identifies one or more IDNs as invalid, it will write the operating data that is still needed or is invalid to this ID No. list. This will be displayed to the drive by command error diagnostic message **C101 Invalid communication parameter (S-0-0021)**.

See also the functional description: "IDN List of Parameters"

S-0-0021 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	no
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0022, IDN-list of invalid op. data for comm. Ph. 3

Before the drive executes a delayed phase switch from 3 to **S-0-0128, C200 Communication phase 4 transition check** with the control system-driven transition check command, the drive will check parameters for the following conditions:

- Validity of the parameter
- The parameter value is found within the valid input range.
- Compatibility with other parameters.

If the result of a parameter check is negative, this operating data will be entered in the ID No. (IDN) list.

The drive then responds to the transition command with the communications error diagnostic messages

- **C201 Invalid Parameter(s) (->S-0-0022) or**
- **C202 Parameter limit error (->S-0-0022) or**
- **C203 Parameter calculation error (->S-0-0022)**

See also the functional description: "IDN List of Parameters"

S-0-0022 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	no
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0024, Config. list of the master data telegram

Note: The parameter supports the internal exchange of data between the drive and the communications processor.

The list can contain only operating data that are listed in the parameter **S-0-0188, List of configurable data in the MDT**.

See also the functional description: "Configuration of Telegram Contents"

S-0-0024 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte var.	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	Phase2
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0025, IDN-list of all procedure commands

The data of the IDN-list contains the ident-numbers of all commands in the drive controller.

See also the functional description: "Commands"

S-0-0025 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	---	**Cyc. transmittable:**	no

S-0-0026, Configuration list signal status word

The data of the parameters stores the ident-numbers of the signals or bits which the signal status word (S-0-0144) contains.

The order of the ident-numbers in the configuration list determines the bit enumeration, beginning with the LSB in the signal status word.

That means, the first ident-number in S-0-0026 defines the bit 0, the second ident-number in S-0-0026 defines bit 1 in the parameter **S-0-0144, Signal status word**, and so on.

Note: The signal status word is used in fieldbus drives for the internal communications betwen the two microcontrollers (exception: P-0-4048 = FFFFh).

See also the functional description: "Configurable signal status word"

S-0-0026 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-- / --		
Default value:	Defaultliste	**Cyc. transmittable:**	no

S-0-0027, Configuration list signal control word

This parameter keeps the ident numbers of the signals or bits contained in the signal control word (S-0-0145).

The order of the ident numbers in the configuration list determines the bit numbering, starting with the LSB in the signal control word. So, the first ident number in S-0-0027 defines the bit 0, the second ident number defines bit 1 in the parameter **S-0-0145, Signal control word**, and so on.

See also the functional description: "Configurable Signal Control Word".

S-0-0027 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	Defaultliste	**Cyc. transmittable:**	-

S-0-0029, MDT error counter

This parameter counts all invalid Master Data Telegrams in communications phases 3 and 4.

If two MDTs fail in direct succession, then error **F402 Double MST error shutdown** will be generated.

The MDT error counter has a limit stop at (2^16) - 1. This means that during a highly distorted transfer the MDT error count will show a value of 65535 after a long time.

S-0-0029 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0030, Manufacturer version

The **version of the drive firmware** can be read from this parameter as plain text. The **structure** of the manufacturer version is defined as follows:

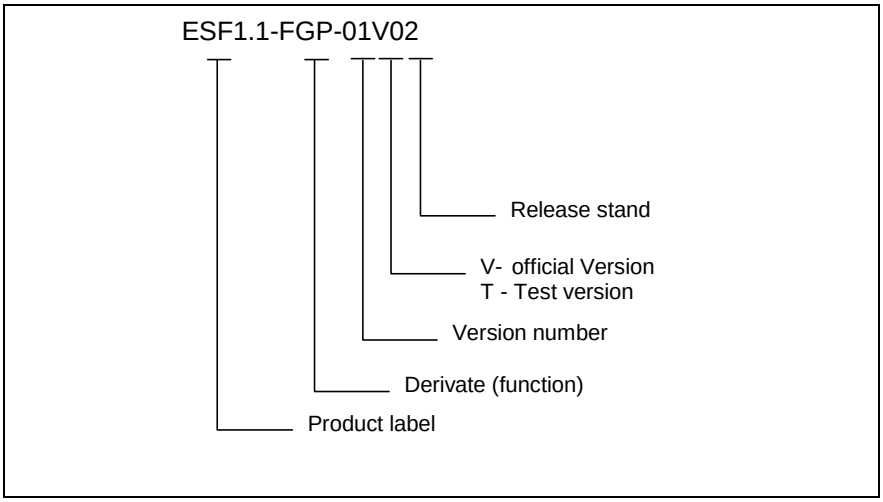


Fig. 2-5: Manufacturer Version

Examples:

HSM1.1-SSE-01V02

ESF1.1-FGP-01V02

See also the functional description: "Systemoverview"

S-0-0030 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	1Byte var.	**Memory:**	constant
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0032, Primary mode of operation

The operating mode set in S-0-0032 is activated in the drive if:

- master control word of the main operating mode is set in S-0-0134, (bit 8 = 0 and bit 9 = 0)
- and the drive is in state "AF".

The user does not directly set the main operating modes with fieldbus drives himself, but rather the preselection of **P-0-4084, Profile type** automatically sets a specific main operating mode!

The control as to which operating mode should be active is set automatically via S-0-0134, master control word (bits 8 and 9) if the fieldbus is active.

Note: Fieldbus units **without active bus communication** (analog mode) can only be operated in the main operating mode (S-0-0032).

Operating mode bit list:	Definition:
0000,0000,0000,0001	torque control
0000,0000,0000,0010	velocity control
0000,0000,0000,x011	position control with encoder 1
0000,0000,0000,x100	position control with encoder 2
0000,0000,0001,x011	drive-internal interpolation, encoder 1
0000,0000,0001,x100	drive-internal interpolation, encoder 2
0000,0000,0011,x011	position control, position block mode, encoder 1
0000,0000,0011,x100	position control, position block mode, encoder 2
1100,0000,0001,1011	jog mode

Fig. 2-6: Mode of Operation

Note: **x=0:** position control with lag
x=1: lagless position control

See also the functional description: "Setting the Operating Mode Parameters".

S-0-0032 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	111011b	**Cyc. transmittable:**	no

S-0-0033, Secondary operation mode 1

The auxiliary modes set in S-0-0033 are activated in the drive if:

- auxiliary operating mode 1 is set in S-0-0134, Master control word (bit 8 = 1 and bit 9 = 0)
- and the drive is in "AF".

The user does not directly set auxiliary mode 1 in fieldbus drives himself but rather a specific auxiliary mode 1 is automatically set with the selection of **P-0-4084, Profile type**!

Note: Fieldbus units without active bus communications (analog mode) can only be operated in main operating mode (S-0-0032).

Operating mode bit list:	Definition:
0000,0000,0000,0001	torque control
0000,0000,0000,0010	velocity control
0000,0000,0000,x011	position control with encoder 1
0000,0000,0000,x100	position control with encoder 2
0000,0000,0001,x011	drive-internal interpolation, encoder 1
0000,0000,0001,x100	drive-internal interpolation, encoder 2
0000,0000,0011,x011	position control/positioning block mode, encoder 1
0000,0000,0011,x100	position control/positioning block mode, encoder 2
1100,0000,0001,1011	jog mode

Fig. 2-7: Bit list S-0-0033

Note: **x=0:** position control with lag
x=1: position control without lag

See also the functional description: "Setting the Operating Mode Parameters".

S-0-0033 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	1100000000011011b	**Cyc. transmittable:**	no

S-0-0034, Secondary operation mode 2

The auxiliary modes set in S-0-0034 are activated in the drive if:

- auxiliary operating mode 2 is set in S-0-0134, Master control word (bit 8 = 1 and bit 9 = 0)
- and the drive is in "AF".

The user does not directly set auxiliary mode 1 in fieldbus drives himself but rather a specific auxiliary mode 1 is automatically set with the selection of **P-0-4084, Profile type**!

Note: Fieldbus units **without active bus communications** (analog mode) can only be operated in main operating mode (S-0-0032).

Operating mode bit list:	Definition:
0000,0000,0000,0001	torque control
0000,0000,0000,0010	velocity control
0000,0000,0000,x011	position control with encoder 1
0000,0000,0000,x100	position control with encoder 2
0000,0000,0001,x011	drive-internal interpolation, encoder 1
0000,0000,0001,x100	drive-internal interpolation, encoder 2
0000,0000,0011,x011	position control/positioning block mode, encoder 1
0000,0000,0011,x100	position control/positioning block mode, encoder 2
1100,0000,0001,1011	jog mode

Fig. 2-8: Bit list S-0-0034

Note: **x=0:** position control with lag
x=1: position control without lag

See also the functional description: "Setting the Operating Mode Parameters"

S-0-0034 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0010b	**Cyc. transmittable:**	no

S-0-0035, Secondary operation mode 3

The auxiliary modes set in S-0-0035 are activated in the drive if:

- auxiliary operating mode 3 is set in S-0-0134, Master control word (bit 8 = 1 and bit 9 = 1)
- and the drive is in "AF".

The user does not directly set auxiliary mode 1 in fieldbus drives himself but rather a specific auxiliary mode 1 is automatically set with the selection of **P-0-4084, Profile type**!

Note: Fieldbus units **without active bus communications** (analog mode) can only be operated in main operating mode (S-0-0032).

Bit list:	Definition:
0000,0000,0000,0001	torque control
0000,0000,0000,0010	velocity control
0000,0000,0000,x011	position control with encoder 1
0000,0000,0000,x100	position control with encoder 2
0000,0000,0001,x011	drive-internal interpolation, encoder 1
0000,0000,0001,x100	drive-internal interpolation, encoder 2
0000,0000,0011,x011	position control/pos. block mode, encoder 1
0000,0000,0011,x100	position control/pos. block mode, encoder 2
1100,0000,0001,1011	jog mode

Fig. 2-9: Bit list S-0-0035

Note: x=0: position control with lag
x=1: position control without lag

See also the functional description: "Setting the Operating Mode Parameters".

S-0-0035 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	11011b	**Cyc. transmittable:**	no

S-0-0036, Velocity command value

This parameter is used to set the velocity command value. This together with **S-0-0037, Additive velocity command value** determines the effective Velocity Command Value for the drive.

Note: In the position control operating modes, this parameter displays the output signal of the position controller.

See also the functional description: "Mode: Velocity Control"

S-0-0036 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0037, Additive velocity command value

The additional velocity command value is added to the **S-0-0036, Velocity command value** in the drive.

See also the functional description: "Mode: Velocity Control"

S-0-0037 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0040, Velocity feedback value

The velocity feedback value can be transferred from the drive control device to the control system

- cyclically
- or acyclically (e.g., service channel in SERCOS)

See also functional description "Preparations for Setting the Velocity Controller".

S-0-0040 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0044	**Extrem value check:**	no
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0041, Homing velocity

The product of **S-0-0041, Homing velocity** and **S-0-0108, Feedrate override** determines the velocity for the **S-0-0148, Drive controlled homing procedure** command.

If, in the case of an absolute encoder, the **S-0-0148, Drive controlled homing** procedure is initiated, then the drive will proceed with this velocity to the reference point (home position) that was determined with the **P-0-0012; set absolute measurement**, command.

See also the functional description: "Drive-Controlled Homing".

S-0-0041 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0044		
Default value:	100000	**Cyc. transmittable:**	no

S-0-0042, Homing acceleration

This parameter indicates the acceleration value at which the drive executes the command **S-0-0148, C600 Drive controlled homing procedure command**.

See also the functional description: "Drive-Controlled Homing".

S-0-0042 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / S-0-0160		
Default value:	100000	**Cyc. transmittable:**	no

S-0-0043, Velocity polarity parameter

This parameter is used to switch the polarity of the velocity data in relation to the application.

Polarities are switched externally, at the input and output of a control system rather than inside the system.

The following applies to rotary motors:

Clockwise rotation when facing the motor shaft is the rule for a **positive** velocity command value and a positive polarity.

The following applies to linear motors:

The **positive direction** is used when the primary is moving **toward** the linear motor power **cable side**.

Parameter structure:

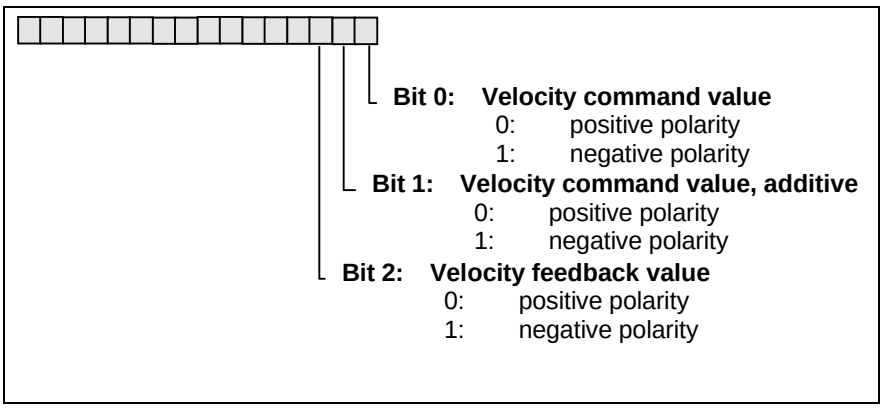


Fig. 2-10: S-0-0043, Velocity polarity parameter

Note: The bits 1 and 2 are copies of bit 0. Only changes of bit 0 have an effect. Different settings of the single bits are not possible!

See also the functional description: "Command polarities and actual value polarities".

S-0-0043 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 7		
Default value:	0	**Cyc. transmittable:**	no

S-0-0044, Velocity data scaling type

Various scaling types can be defined for the velocity data in the drive.

Examples: RPM → rotary

mm/min → linear

Structure of the parameter:

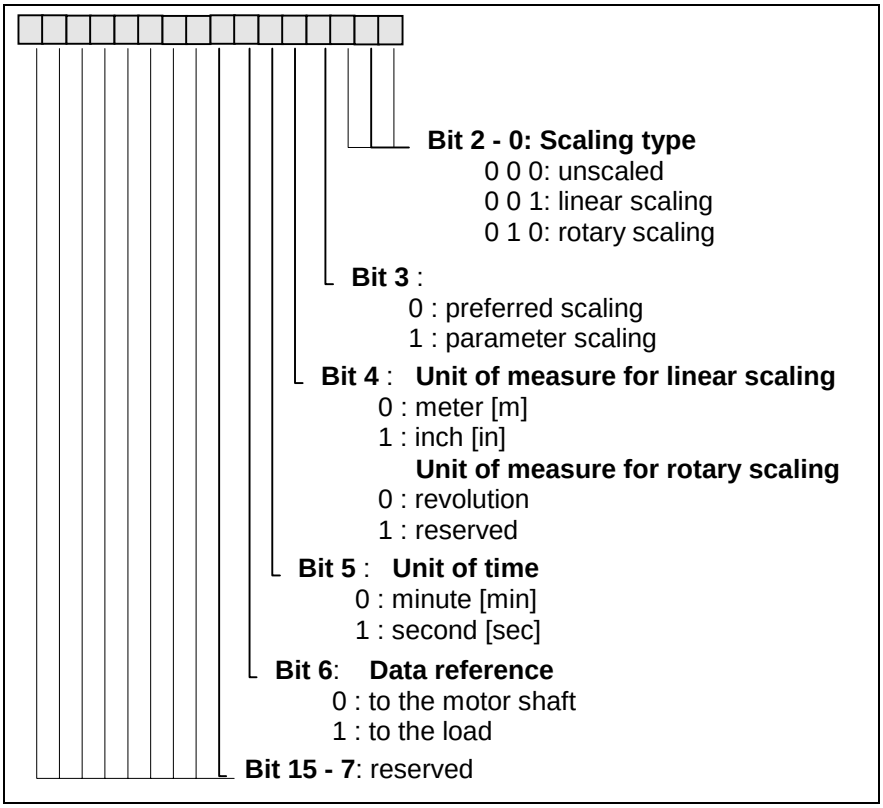

Bit 2 - 0: Scaling type
0 0 0: unscaled
0 0 1: linear scaling
0 1 0: rotary scaling
Bit 3 :
0 : preferred scaling
1 : parameter scaling
Bit 4 : Unit of measure for linear scaling
0 : meter [m]
1 : inch [in]
Unit of measure for rotary scaling
0 : revolution
1 : reserved
Bit 5 : Unit of time
0 : minute [min]
1 : second [sec]
Bit 6: Data reference
0 : to the motor shaft
1 : to the load
Bit 15 - 7: reserved

Fig. 2-11: S-0-0044, Velocity Data Scaling Type

In bit 3 it is possible to select between preferred and parameter scaling.

Preferred scaling:

The following parametrs are predefined in this case and cannot be changed:

- **S-0-0045, scaling factor for velocity data**
- **S-0-0046, scaling exponents for velocity data**

Scaling with parameter scaling means that this parameter must be specified.

(See section: "Preferred / parameter scaling")

See also example under **S-0-0045, Velocity Data Scaling Factor**

and functional description: "Velocity Data Display Format"

S-0-0044 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	1010b	**Cyc. transmittable:**	no

S-0-0045, Velocity data scaling factor

This parameter defines the scaling factor for all velocity data in the drive.

If preferred scaling is set with **S-0-0044, Velocity data scaling type**, this parameter will be set to 1.

See also the functional description: "Velocity Data Display Format"

S-0-0045 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 65535		
Default value:	1	**Cyc. transmittable:**	no

S-0-0046, Velocity data scaling exponent

The scaling exponent for all velocity data in the drive is determined in this parameter.

See also functional description: "Velocity data display format".

S-0-0046 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-32 / 32		
Default value:	-4	**Cyc. transmittable:**	no

S-0-0047, Position command value

Parameter S-0-0047 must be configured in the real time channel (master -> slave) in "cyclical position control" mode.

S-0-0047 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0049, Positive position limit value

The positive position limit value describes the maximum extent of travel in the positive direction.

Activation

The position limit value is active only when all position data refers to the homing point, i.e., the drive is **homed** (bit 0 is set to 1 in parameter **S-0-0403, Position feedback value status**).

The position limit values can be switched off using bit 4 in **S-0-0055, Position polarity parameter**.

Warning

If a **Target position, S-0-0258** beyond the positive position limit value is set for the drive, then the drive sets warning bit 13 in **S-0-0012, Class 2 diagnostic** and generates the warning **E253 Target position out of travel range**.

If the positive position limit value is exceeded, the drive sets error bit 13 in **S-0-0011, Class 1 diagnostic**.

See also the functional description: "Axis limit values".

S-0-0049 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	1000000	**Cyc. transmittable:**	no

S-0-0050, Negative position limit value

The negative position limit value describes the maximum extent of travel in the negative direction.

Activation

The position limit value is active only when all position data refers to the homing point, i.e. the drive is **homed** (bit 0 is set to 1 in parameter **S-0-0403, Position feedback value status**). The position limit values can be switched off using bit 4 in **S-0-0055, Position polarity parameter**.

Warning

If a target position beyond the negative position limit value is set for the drive, then the drive sets warning bit 13 in **S-0-0012, Class 2 diagnostic** and generates the warning **E253 Target position out of travel range**.

If the negative position limit value is exceeded, the drive will set error bit 13 in **S-0-0011, Class 1 diagnostics**.

See also the functional description: "Axis limit values".

S-0-0050 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	-1000000	**Cyc. transmittable:**	no

S-0-0051, Position feedback 1 value

Position feedback value 1 represents the current position of the motor encoder. The initialization of the position feedback happens during the execution of **S-0-0128, C200 Communication phase 4 transition check**; that means, the feedback positions are only initialized after successful execution of the command.

If an absolute encoder is present, the value in **S-0-0051, Position Feedback 1 Value** then shows the absolute position referred to the machine's zero-point, provided that during the first setup the command **P-0-0012, C300 Command 'Set absolute measurement'** has been executed once.

In the other case, the initialization value depends on whether the parameter **P-0-0019, Position start value** has been written to during the phase progression or whether the motor feedback is an absolute encoder.

See also the functional description: "Setting the Measurement System".

S-0-0051 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0052, Reference distance 1

The parameter displays the distance between the machine zero-point and the homing point for the motor measurement system (Position feedback value 1). The parameter is used for the execution of the commands
S-0-0148, C600 Drive controlled homing procedure command and **P-0-0012, C300 Command 'Set absolute measurement'**.

During the command **S-0-0148, C600 Drive controlled homing procedure command**, the distance between the homing point and the machine zero-point is written there. If homing is done with run to the homing point, the drive goes to the homing point, and **S-0-0051, Position feedback 1 value** contains the value of **S-0-0052, Reference distance 1**.

For the command **P-0-0012, C300 Command 'Set absolute measurement'**, the desired value for **S-0-0051, Position feedback 1 value** is written there. After successful execution of 'Setting absolute measurement', **S-0-0051, Position feedback 1 value** shows the value of **S-0-0052, Reference distance 1**.

See also the functional description: "Drive-controlled homing".

S-0-0052 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0053, Position feedback 2 value

Position feedback value 1 represents the current position of the **optional external encoder**. The initialization of the position feedback happens during the execution of **S-0-0128, C200 Communication phase 4 transition check**; that means, the feedback positions are only initialized after successful execution of the command.

If an absolute optional encoder is present, the value in **S-0-0053, Position Feedback Value 2** then shows the absolute position referred to the machine's zero-point, provided that during the first setup the command **P-0-0012, C300 Command 'Set absolute measurement'** has been executed once.

In the other case, the initialization value depends on whether the parameter **P-0-0019, Position start value** has been written to during the phase progression or whether an existing optional feedback is an absolute encoder.

See also the functional description: "Setting the Measurement System".

S-0-0053 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0054, Reference distance 2

The parameter displays the distance between the machine zero-point and the homing point for the external measuring system (Position feedback value 2). The parameter is used for the execution of the commands **S-0-0148, C600 Drive controlled homing procedure command** and **P-0-0012, C300 Command 'Set absolute measurement'**.

During the command **S-0-0148, C600 Drive controlled homing procedure command**, the distance between the homing point and the machine zero-point is written there. If homing is done with run to the homing point, the drive goes to the homing point, and **S-0-0053, Position feedback 2 value** contains the value of **S-0-0054, Reference distance 2**.

For the command **P-0-0012, C300 Command 'Set absolute measurement'**, the desired value for **S-0-0053, Position feedback 2 value** is written there. After successful execution of 'Setting absolute measurement'**, S-0-0053, Position feedback 2 value** shows the value of **S-0-0054, Reference distance 2**.

See also the functional description: "Drive-controlled homing".

S-0-0054 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0055, Position polarities

This parameter can be used to invert the polarities of the given position data. These polarities are switched outside of the control system (i.e., at the input and output of the control system).

Note: The polarity of the position must be determined during the first setup of an axis *before* establishing a zero reference for the measurement systems, because changing the polarity results in different position values.

Note the following in reference to rotary motors:

"Motor-clockwise rotation" means the motor shaft turns in a clockwise direction (facing the motor shaft) if the position command value difference and the polarity are both positive.

The following applies to linear motors:

The positive direction is used when the primary is moving toward the linear motor power cable side

Bit 4 is used to activate or deactivate software position limits.

Parameter structure:

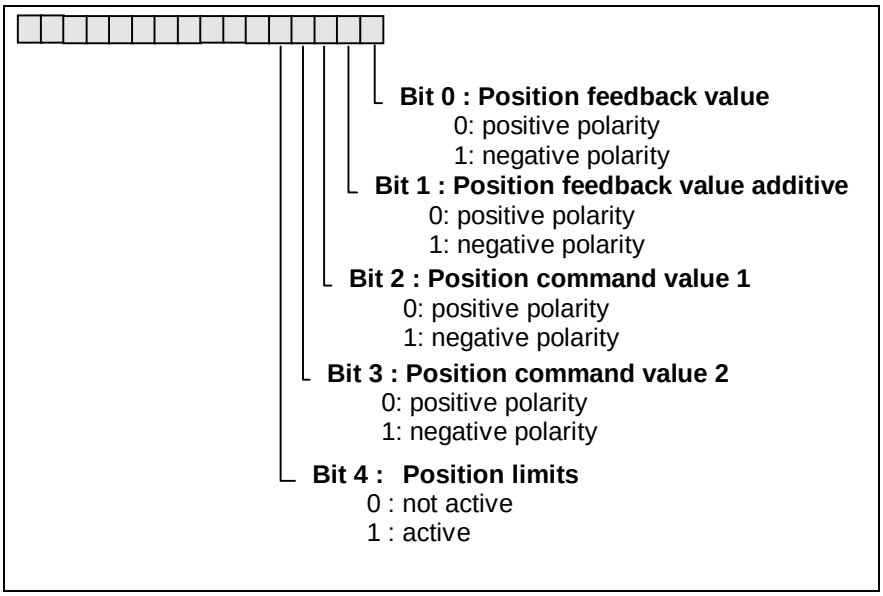

Bit 0 : Position feedback value
0: positive polarity
1: negative polarity
Bit 1 : Position feedback value additive
0: positive polarity
1: negative polarity
Bit 2 : Position command value 1
0: positive polarity
1: negative polarity
Bit 3 : Position command value 2
0: positive polarity
1: negative polarity
Bit 4 : Position limits
0 : not active
1 : active

Fig. 2-12: S-0-0055, Position polarity parameter

Note: - Only the bits indicated here are supported by the software.
- If bit 0 is changed by the control system, bits 1 - 3 will also be set to the value of bit 0 by the drive!

See also the functional description: "Command polarities and actual value polarities".

S-0-0055 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 15		
Default value:	0	**Cyc. transmittable:**	no

S-0-0057, Position window

The parameter S-0-0057, Position window, is used for following functions:

- Status **In Position**, |Following error (S-0-0189)| < Position window (S-0-0057) sets bit 6 in **S-0-0013, Class 3 Diagnostics**
- Status **ITP**, |Target - act.pos.|< Position window (S-0-0057) && |following error| < Position window && |act. speed| < Standstill window (S-0-0124) → bit 6 in **S-0-0182,** Manufacturer class 3 diagnostics
- Status **In_Target_Position**, |Target - act.pos.| < Position window (S-0-0057) → Bit 10 in **S-0-0182,** Manufacturer class 3 diagnostics
- Status **Final position reached,** (|Target - act.pos-1/2| < S-0-0057, Position window) && **Last process block** done
- During the execution of the command **S-0-0148,** C600 Drive controlled homing procedure command, the drive reports completion of the command, when the internal command generator has reached its target value and the difference between this value and the actual position is smaller than the position window.
- As a **hysteresis** window for the position limits. I.e., when the drive has gone beyond the limit, the travel range is additionally limited by the position window.
- As hysteresis window for dynamic cam groups.
- If position limit value is active, then there is a positioning to the position limit value positioning window when **jogging**.
- Target positions within the window are run to over the shortest path regardles of what is set in S-0-0393.

See also the functional description: "S-0-0182, Manufacturer class 3 diagnostics".

S-0-0057 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	1000	**Cyc. transmittable:**	no

S-0-0076, Position data scaling type

The position data scaling type determines, in which format position data are communicated between drive and control or display surface. When position parameters (e.g. **S-0-0051, Position feedback 1 value**) are read, the drive displays them with the selected scaling. The scaling selection is usually preset by the PLC. The following settings can be made:

Structure of the parameter:

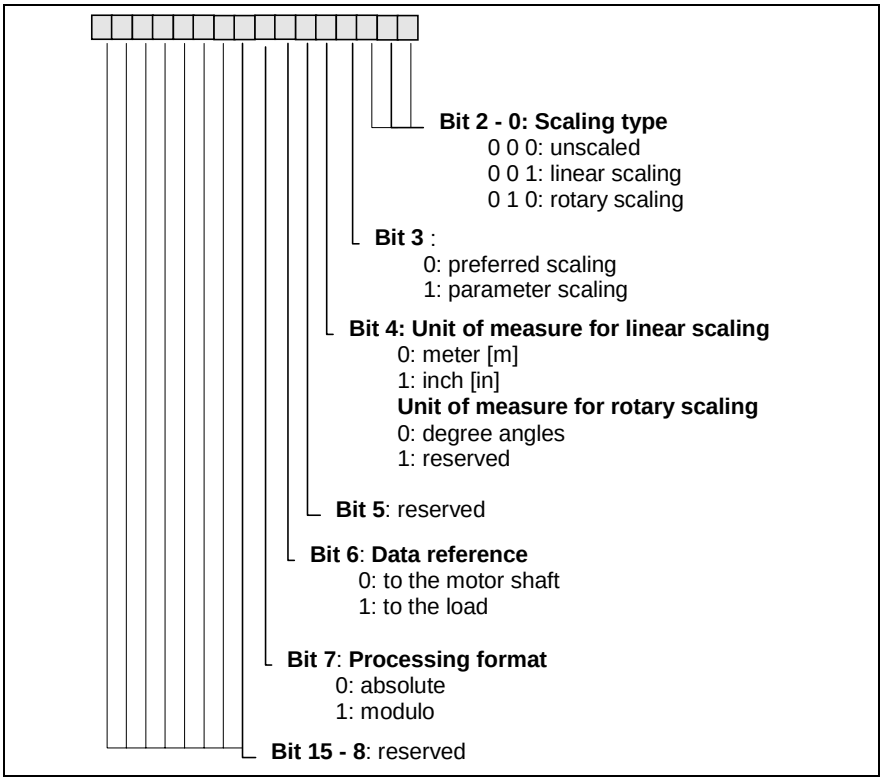

Bit 2 - 0: Scaling type
0 0 0: unscaled
0 0 1: linear scaling
0 1 0: rotary scaling
Bit 3 :
0: preferred scaling
1: parameter scaling
Bit 4: Unit of measure for linear scaling
0: meter [m]
1: inch [in]
Unit of measure for rotary scaling
0: degree angles
1: reserved
Bit 5: reserved
Bit 6: Data reference
0: to the motor shaft
1: to the load
Bit 7: Processing format
0: absolute
1: modulo
Bit 15 - 8: reserved

Fig. 2-13: S-0-0076, Position data scaling type

In bit 3 the selection between preferred and parameter scaling can be set.

Preferred scaling:

The followng parameters are predefined and cannot be changed:

- **S-0-0077, Linear position data scaling factor,**
- **S-0-0078, Linear position data scaling exponent**
- **S-0-0079, Rotational position resolution**

Parameter scaling means that this parameter must be set for scaling (see section: preferred / parameter scaling).

Note: Only the bits mentioned here are supported by the firmware.
1) See also **S-0-0045, Scaling factor for velocity data**.
2) See also the example **S-0-0077, Scaling of position data**.

See also the functional description: "Display Format of Position Data".

S-0-0076 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	1010b	**Cyc. transmittable:**	no

S-0-0077, Linear position data scaling factor

The parameter **S-0-0077, Linear position data scaling factor** determines together with **S-0-0078, Linear position data scaling exponent** and the selection of the physical unit m (meters) or inch in S-0-0076, in which unit the present position parameters in the drive are displayed, when linear scaling is selected.

If "preferred scaling“ is chosen in **S-0-0076, Position data scaling type** (bit 3 = 0), the values in S-0-0077 and S-0-0078 are set by the drive.

If "**parameter scaling**“ is chosen in **S-0-0076, Position data scaling type** (bit 3 = 1), the settings in S-0-0077 and S-0-0078 are taken.

Example for the display of position data for linear scaling:

- Physical position of the motor feedback equals 0.12 m (meter).

A) Selected scaling = linear preferred scaling (S-0-0077 = 1, S-0-0078 = -7). This gives for **S-0-0051, Position feedback 1 value** a value of 1200000 with unit meters and 7 places after the decimal.

B) Selected scaling = linear parameter scaling (S-0-0077 = 3, S-0-0078 = -7). This gives for **S-0-0051, Position feedback 1 value** a value of 400000 with unit meters and 7 places after the decimal.

See also the functional description: "Display Format of Position Data".

S-0-0077 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 65535		
Default value:	1	**Cyc. transmittable:**	no

S-0-0078, Linear position data scaling exponent

The parameter **S-0-0078, Linear position data scaling exponent** determines together with **S-0-0077, Linear position data scaling factor** and the selection of the physical unit m (meters) or inch in S-0-0076, in which unit the present position parameters in the drive are displayed, when linear scaling is selected.

If "preferred scaling“ is chosen in **S-0-0076, Position data scaling type** (bit 3 = 0), the values in **S-0-0077** and **S-0-0078** are set by the drive.
If "parameter scaling“ is chosen in **S-0-0076, Position data scaling type** (bit 3 = 1), the settings in **S-0-0077** and **S-0-0078** are taken.

Example for the display of position data for linear scaling:
- Physical position of the motor feedback equals 0.12 m (meter).
A) Selected scaling = linear preferred scaling (S-0-0077 = 1, S-0-0078 = -7). This gives for **S-0-0051, Position feedback 1 value** a value of 1200000,0 with unit meters and 7 places after the decimal.
B) Selected scaling = linear parameter scaling (S-0-0077 = 1, S-0-0078 = -6). This gives for **S-0-0051, Position feedback 1 value** a value of 120000 with unit meters and 6 places after the decimal.
See also the functional description: "Display Format of Position Data".

S-0-0078 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-32768 / 32768		
Default value:	-7	**Cyc. transmittable:**	no

S-0-0079, Rotational position resolution

If rotary position scaling is selected, the LSB valence for all position data will be set in this parameter. The valence of the LSB in the drive's position data results in

$$\text{LSB valence} = \frac{1 \text{ Revolution}}{\text{Rotational position resolution}}$$

where bit 6 of **S-0-0076, Position data scaling type** selects whether the LSb valence refers to one motor revolution or one load revolution.

If you work with preferred rotary scaling, the value in S-0-0079, Rotational position resolution is fixed at 3 600 000. Thus, the LSB bit of all rotary position data is fixed at 0.0001 degrees of angle.

See also the functional description: "Display Format of Position Data".

S-0-0079 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 4294967295		
Default value:	3600000	**Cyc. transmittable:**	no

S-0-0080, Torque/Force command

If the velocity controller is active, the torque required for the corresponding velocity can be derived from this parameter.

The evaluation depends upon the scaling of the torque and force data. At present, only the **percentage-based scaling** is supported.

The date value corresponds to the current command value in respect to the motor current at standstill (S-0-0111).

100 % = Motor continous standstill torque, Mdn

The value can be converted to a torque or force value by multiplying the command current by the torque/force constant (P-0-0051).

See also the functional description: "Torque Control".

S-0-0080 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0086	**Extrem value check:**	yes
Decimal places:	S-0-0086	**Combination check:**	no
Input min/max:	S-0-0109/110 / S-0-0109/110		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0084, Torque/Force feedback value

The current torque/force feedback value can be derived from this parameter.

The shown values depend from the torque/force scaling. At present, only the percentage-based scaling is supported.

The data value corresponds to the measured feedback current; 100% are equal to the motor current at standstill, S-0-0111.

The value can be converted to a torque or force value by multiplying the command current by the torque/force constant P-0-0051.

S-0-0084 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0086	**Extrem value check:**	no
Decimal places:	S-0-0086	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0085, Torque/Force polarity parameter

The polarities for the given torque data as related to the application can be switched in this parameter.

Polarities are switched externally, at the input and output of a control system rather than inside the system.

The following applies to rotary (turning) motors:

The motor will turn in a clockwise direction (facing the motor shaft) with a positive torque command value and positive polarity.

The following applies to linear motors:

The positive direction is used when the primary is moving toward the linear motor power cable side

Structure of the parameter:

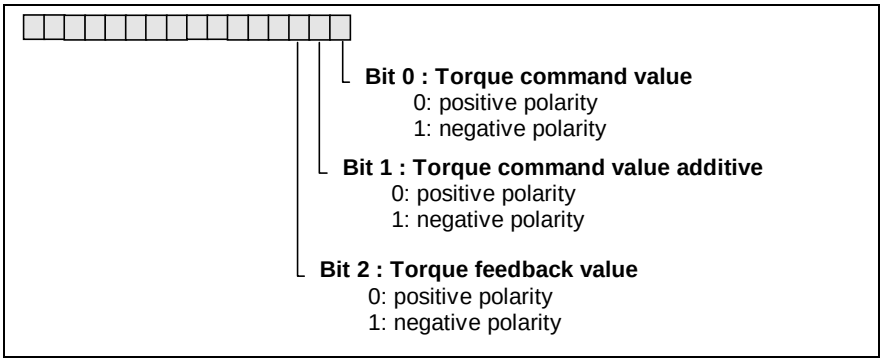

Bit 0 : Torque command value
0: positive polarity
1: negative polarity
Bit 1 : Torque command value additive
0: positive polarity
1: negative polarity
Bit 2 : Torque feedback value
0: positive polarity
1: negative polarity

Fig. 2-14: S-0-0085, Torque/force polarity parameter

Note: If bit 0 of the control system is changed, then bits 1 - 2 of the drive will also be set to the value in bit 0.

See also the functional description: "Command polarities and actual value polarities".

S-0-0085 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 7		
Default value:	0	**Cyc. transmittable:**	no

S-0-0086, Torque/Force data scaling type

At present, only the percentage scaling for torque/force data is supported.

The following applies:

100 % = S-0-0111, Motor current at standstill

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data".

S-0-0086 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0091, Bipolar velocity limit value

The "bipolar velocity limit value" describes the maximum permissible velocity, symmetrical in both directions. The max. input value is determined by the **S-0-0113, Maximum motor speed (nmax)**.

The entered value generates the maximum value for all other speed parameters.

See also the functional description: "Limiting Velocity"

S-0-0091 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0113		
Default value:	1000000	**Cyc. transmittable:**	MDT

S-0-0092, Bipolar torque/force limit value

This parameter describes the maximum allowable torque symmetrical in both directions (accelerating, braking).

The evaluation refers to the percentage of the motor current at standstill:

100 % = Motor current at standstill

Note: The maximum torque is also influenced by
- **P-0-0006, Overload factor**
- **P-0-4011, Switching frequency**

See also the functional description: "Torque/Force Limiting".

S-0-0092 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0086	**Extrem value check:**	yes
Decimal places:	S-0-0086	**Combination check:**	no
Input min/max:	S-0-0109/110 / S-0-0109/110		
Default value:	4000	**Cyc. transmittable:**	MDT

S-0-0093, Torque/force data scaling factor

The scaling factor for all torque/force data in the drive is set in this parameter.

The parameter has no meaning at the present time, because only percentage scaling can be set for torque and force data. Therefore, only the value 1 is suitable.

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data".

S-0-0093 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 1		
Default value:	1	**Cyc. transmittable:**	no

S-0-0094, Torque/force data scaling exponent

The scaling exponent for all torque/force data in the drive is set in this parameter.

The parameter has no meaning at the present time, because only percentage scaling can be set for torque and force data.

See also the functional description: "Adjustable scaling for position, velocity, and acceleration data".

S-0-0094 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-1 / -1		
Default value:	-1	**Cyc. transmittable:**	no

S-0-0095, Diagnostic message

The operating status for the drive that is relevant at the moment can be read in **text** form in this parameter.

The respective diagnostic message number from **S-0-0390, Diagnostic Message Nummer** will appear in front of this parameter.

Example: "A010 Drive Halt"

See also the functional description: "Diagnostic Message"

S-0-0095 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	1Byte var.	**Memory:**	no
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0096, Slave arrangement (SLKN)

The master uses this information to detect the address of the connected slave.

Example for address 3:

Contents S-0-0096	03	03

S-0-0096 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	constant
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0097, Mask class 2 diagnostic

This parameter can be used to mask pre-warnings in the **S-0-0012, Class 2 diagnostics** concerning their effect on the change bit in the drive status. When the masked early warnings change, the Class 2 diagnostic change bit will be set in the drive status.

The mask has no effect on the operating data of the Class 2 diagnostics.

Moreover, this parameter can mask pre-warnings in the **S-0-0012, Class 2 diagnostics** concerning their effect on the warning output.

Note: A warning masked out by this mask will only be displayed in the data of the Class 2 diagnostics, but woll not lead to setting the warning output.

See also the functional description: "Change bit of class 2 and 3 diagnostics in the drive status word".

S-0-0097 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0098, Mask class 3 diagnostic

This parameter can be used to mask pre-warnings in the **S-0-0013, Class 3 diagnostics** in the drive status according to their effect on the change bit. When the masked early warnings change, the Class 3 diagnostics change bit will be set in the drive status.

The mask has no effect on the operating data of the Class 3 diagnostics.

Moreover, this parameter can mask pre-warnings in the **S-0-0013, Class 3 diagnostics** concerning their effect on the warning output.

Note: A warning masked out by this mask will only be displayed in the data of the Class 3 diagnostics, but woll not lead to setting the warning output.

See also the functional description: "Change bit of class 2 and 3 diagnostics in the drive status word".

S-0-0098 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0099, C500 Reset class 1 diagnostic

Command to **reset errors**, after the cause has been cleared.

This command can be started with

- the S1 key on the drive controller or
- by writing to the parameter **S-0-0099, C5 Reset class 1 diagnostic**

When starting the command via the parameter S-0-0099, all errors in the drive are cleared, and the drive will switch to the "ready for operation" status if no further error remains.

If the command is started with the S1 key, only one error is deleted at a time. If the drive has stored several errors (up to 4 errors), the diagnostic message that corresponds to each error will appear sequentially every time the S1 key is pressed again.

See also the function description: "Clearing errors".

S-0-0099 - Attributes

Function:	Command	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0100, Velocity loop proportional gain

This parameter contains the value for the velocity loop proportional gain.

The proportional gain **unit** depends on the contacted motor type.

Motor type:	**Unit:**
Rotary motor:	A•sec/rad
Linear motor:	A•min/m

Fig. 2-15: Units for the vel. loop prop. gain depending on the motor type

It is possible to load a default value for the parameter using the command "Basic load", as long as there is a motor with feedback memory (**P-0-4014, Motor type:** 1 or 5).

See also the functional description: "Setting the velocity controller".

S-0-0100 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	As/rad	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 6553.5		
Default value:	10	**Cyc. transmittable:**	no

S-0-0101, Velocity loop integral action time

The velocity controller forms a current command value from the difference between the velocity command value and the velocity feedback value

(= speed regulation deviation).

This current command value consists of a proportional component and an integral component. The Velocity Loop Integral Action Time corresponds to the time in which the integral component of the current command value is growing on the value of the proportional component.

Definition of the Integral Action Time

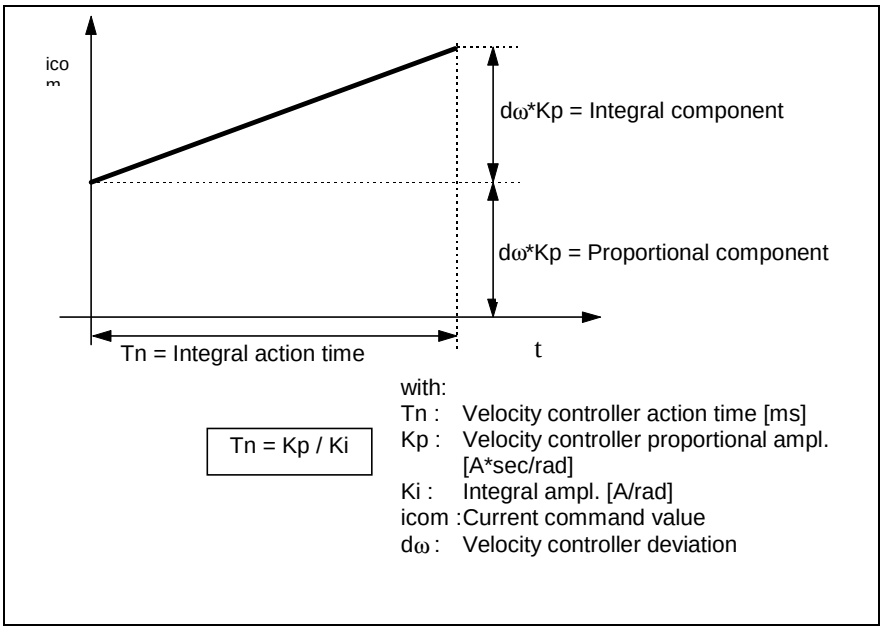


Fig. 2-16: Integral Action Time

The value of the time axis for which the integral component is equal to the proportional component is described as integral action time. This represents the time that a pure I-controller would need until the controller output variable is equal to the output variable of a P-controller at time t=0.

The integral gain component is disabled with an input value of 0.

See also the functional description: "Setting the velocity controller".

S-0-0101 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 6553.5		
Default value:	100	**Cyc. transmittable:**	no

S-0-0103, Modulo value

When the modulo format is set (parameter **S-0-0076, Position data scaling type** bit 7), the modulo value determines at which numeric value the position data roll over (overflow) to 0.

See also parameter "**S-0-0393, Command value mode**"

See also the functional description: "Modulo feature".

and "Modulo Processing-Limiting Conditions"

S-0-0103 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	3600000	**Cyc. transmittable:**	no

S-0-0104, Position loop Kv-factor

This parameter contains the value for the proportional gain of the position controller.

It is possible to load a default value for the controller parameters using the command "Basic load".

Motors with feedback memory e.g. MKD, have appropriate values for all controller settings in their feedback. These are loaded after the initial connection (display UL) or with the command "Basic load“.

See also the functional description: "Setting the position controller".

S-0-0104 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	1000/min	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 655.35		
Default value:	100	**Cyc. transmittable:**	no

S-0-0106, Current loop proportional gain 1

The current controller proportional gain is determined for every motor-drive combination. It depends on the type of the motor and may not be changed. It is loaded from the motor feedback after the initial connection (display UL) or using the command "Basic load".

Note: The values of the current controller set at the factory should not be altered!

See also function description: "Setting the Current Controller".

S-0-0106 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	V/A	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 655.35		
Default value:	100	**Cyc. transmittable:**	no

S-0-0107, Current loop integral action time 1

The current loop integral action time is fixed for every motor-drive combination. It depends on the type of the motor. The factory setting may not be changed.

The basic setup for all controllers is loaded after the initial connection (display UL) or with the command "Basic load“. For motors without feedback memory, you can take the value from the motor’s data sheet.

See also function description: "Setting the Current Controller".

S-0-0107 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 6553.5		
Default value:	100	**Cyc. transmittable:**	no

S-0-0108, Feedrate override

The feedrate override acts on drive controlled operation modes and motion commands, like

- **S-0-0148, C600 Drive controlled homing procedure command**
- operating modes Drive internal interpolation and Relative drive internal interpolation
- Programmed positioning block operating mode
- Jogging operation
- automatic control loop setting

Note: The versions have not implemented all operating modes and commands at the same time.

The feedrate override has a **multiplying** effect on the parameters

- **S-0-0041, Homing velocity**
- **S-0-0259, Positioning velocity**
- Positioning block velocities
- Jog velocity

Note: In devices with analog interface, an analog input can be configured for the feedrate override, see also the project manual.

See also the functional description: "Drive-Controlled Homing".

S-0-0108 - Attributes

Function:	Parameter	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	%	**Extrem value check:**	no
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 655.35		
Default value:	---	**Cyc. transmittable:**	no

S-0-0109, Motor peak current

Specifies the maximum current which may flow through the motor for a short period without damaging it.

Note: If the motor's peak current is less than the amplifier's peak current, the maximum output current will be automatically limited to the motor's peak current.

This value is stored in the motor feedback for MHD, MKD and MKE motors and will be uploaded from there when the amplifier is turned on for the first time. For other motor types, the value must be taken from the data sheet.

See also the functional description: "Setting the Active Peak Current".

S-0-0109 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	1000	**Cyc. transmittable:**	no

S-0-0110, Amplifier peak current

Peak current available from the drive controller. The value will be set by the drive itself. This current is only available for short durations.

See also the functional description: "Current Limit".

S-0-0110 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	---	**Cyc. transmittable:**	no

S-0-0111, Motor current at standstill

The motor current at standstill is the current from which the motor continuously generates the standstill torque according to the motor data sheet.

This value is stored in motor feedback for MHD, MKD and MKE motors and will be loaded from there when the drive controller is turned on for the first time. For other types of motors, this value must be taken from the data sheet.

Note: All torque/force data refer to this motor current at standstill = 100 % .

See also the functional description: "Motor Feedback-Data Memory"

S-0-0111 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	1000	**Cyc. transmittable:**	no

S-0-0112, Amplifier nominal current

Allowable continuous current output for the drive controller. The value will be set by the drive itself.

See also the functional description: "Setting the Active Continuous Current"

S-0-0112 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	---	**Cyc. transmittable:**	no

S-0-0113, Maximum motor speed (nmax)

The maximum velocity for the motor cannot be exceeded. It also limits the **S-0-0091, Bipolar velocity limit** parameter.

This value is stored in the motor feedback of MHD, MKD and MKE motors and will be loaded from there when the drive controller is turned on for the first time. For other motor types, the value must be taken from the data sheet.

In torque regulation, if the maximum motor speed is exceeded by more than 12.5%, the drive will be switched into a torque free state and the error message **F879 Velocity limit S-0-0091 exceeded** will result.

See also the functional description: "Limiting Velocity".

S-0-0113 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / 214738.3647		
Default value:	1000000	**Cyc. transmittable:**	no

S-0-0115, Position feedback 2 type

Essential characteristics of the optional encoder (position encoder 2) are established is this parameter.

Parameter structure:

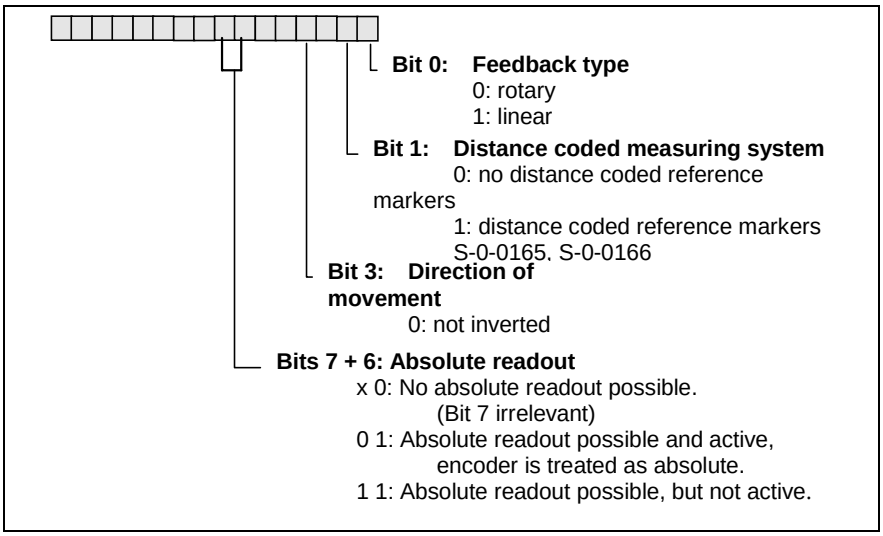

Bit 0: Feedback type
0: rotary
1: linear
Bit 1: Distance coded measuring system
0: no distance coded reference markers
1: distance coded reference markers S-0-0165, S-0-0166
Bit 3: Direction of movement
0: not inverted
Bits 7 + 6: Absolute readout
x 0: No absolute readout possible. (Bit 7 irrelevant)
0 1: Absolute readout possible and active, encoder is treated as absolute.
1 1: Absolute readout possible, but not active.

Fig. 2-17: S-0-0115, Position feedback 2 type parameter

Remark:

For absolute measurement systems with data memory, bit 6 is set automatically.

See also the functional description: "Other optional Encoder Characteristics".

S-0-0115 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0116, Feedback 1 Resolution

Depending on parameter **P-0-4014, Motor type** (rotary or linear motors), the resolution of the motor encoder is indicated by **S-0-0116, Resolution of motor feedback**.

This value contains the number of lines or cycles per motor revolution for rotary motors, or the segment spacing per mm for linear motors. For motors with resolver feedback, the number of the resolver pole pairs is stored here.

See also the functional description: "Motor encoder resolution".

S-0-0116 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Cycles/Rev	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	256	**Cyc. transmittable:**	no

S-0-0117, Feedback 2 Resolution

The resolution of the optional encoder contains the cycles per external encoder revolution for rotational encoders. For linear optional encoders, the segment spacing is given, in mm.

See also the functional description: "Optional Encoder Resolution".

S-0-0117 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Cycles/Rev	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	256	**Cyc. transmittable:**	no

S-0-0121, Input revolutions of load gear

A mechanical gear is often employed between the motor and the load.

The **gear ratio** is defined by:

$$\frac{\textbf{S-0-0122, Output Revolutions of load Gear}}{\textbf{S-0-0121, Input Revolutions of load Gear}}$$

Fig. 2-18: Gear Ratio

See also function description: "Transmission Ratio“ and "Modulo Processing-Limiting Conditions".

Example:

5 motor rotations result in 2 output gear rotations.

$$\Rightarrow \quad \frac{\text{S-0-0121 : 5}}{\text{S-0-0122 : 2}}$$

S-0-0121 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Rev	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 4294967295		
Default value:	1	**Cyc. transmittable:**	no

S-0-0122, Output revolutions of load gear

A mechanical gear is often employed between the motor and the load.

The gear ratio is defined by:

$$\frac{\text{S-0-0122, Output Revolutions of load Gear}}{\text{S-0-0121, Input Revolutions of load Gear}}$$

Fig. 2-19: Gear Ratio

See also function description: "Transmission Ratio" and "Modulo Processing-Limiting Conditions".

Example:

5 motor rotations result in 2 output gear rotations.

⇒ S-0-0121 : 5
S-0-0122 : 2

S-0-0122 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Rev	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 4294967295		
Default value:	1	**Cyc. transmittable:**	no

S-0-0123, Feed constant

This parameter describes the conversion from rotary to linear motion. It is defined as the linear displacement of the load during one revolution of the gear drive shaft.

Characteristic value:

Ball screw spindle:	**Rack and pinion:**
Feed constant = pitch of screw (typical value 10.00 mm)	Feed constant = effective pitch diameter of the pinion • π = effective circumference of the pinion

Fig. 2-20: Characteristic values of the feed constant

Note: The unit is dependent on bit 4 in **S-0-0076, Position data scaling type**.

Note that: S-0-0076 bit 4 = 0 → mm/rev
S-0-0076 bit 4 = 1 → inch/rev

See also the functional description: "Feed constant".

S-0-0123 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	5	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	100000	**Cyc. transmittable:**	no

S-0-0124, Standstill window

The motors standstill is an indication that the **velocity feedback value, (S-0-0040)** has reached below the pre-define threshold level in S-0-0125.

Bit 1 of the **S-0-0013, Class 3 diagnostics** is set during standstill.

The standstill window also works:

- if termination or interruption of a drive control command is acknowledged when the drive is standing
- with drive-controlled homing, the actual and command values are not switched until the drive is standing

- command value processing is initilized upon operating mode switch to velocity = 0 if actual velocity is smaller than standstill window

See also the functional description: "S-0-0182, Manufacturer class 3 diagnostic"

S-0-0124 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0044		
Default value:	100000	**Cyc. transmittable:**	no

S-0-0125, Velocity threshold nx

If the **S-0-0040, Velocity feedback value** falls below the value of the parameter **S-0-0125, Velocity threshold nx**, the drive sets the message n_actual < nx (Bit 2 in **S-0-0013, Class 3 Diagnostics**).

See also the functional description: "S-0-0013, Class 3 Diagnostics".

S-0-0125 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Prog.-Modul
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0044		
Default value:	10000000	**Cyc. transmittable:**	no

S-0-0127, C100 Communication phase 3 transition check

The command "**S-0-0127, C100 Communication phase 3 transition check** is used to switch form the parameteri mode to the operating mode.

If invalid parameters are pending, then

- the drive completes the command with an error message
- and the invalid parameters are entered in parameter S-0-0021, IDN list of invalid operating data phase 2!

Note: The execution of the command also causes the switch into phase 3 but only if (P-0-4086 = xx1b) command communications (SERCOS or fieldbus) is inactive.

This makes it possible, using commands

- **S-0-0127, C100 communications phase 3 transition check**
- **S-0-0128, C200 communications phase 4 transition check**

to switch (with inactive command communications (P-0-4086 = xx**1**b)) from **Parametrization** into **operating** mode.

See also Function description: "Position Command Value Monitoring".

S-0-0127 - Attributes

Function:	Command	**Editability:**	P2
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0128, C200 Communication phase 4 transition check

When the **S-0-0128, C200 Communication phase 4 transition check** command is executed , all parameters will be checked for validity and limit value encroachments.

- If any invalid parameters or any limit values have been encroached upon, the drive would end the command with an error message
- and the invalid parameter entered in parameter S-0-0022, IDN list of invalid operating data phase 3!

The execution of the command, however, with an **inactive** (P-0-4086 = xx**1**b) **command communication** (SERCOS or fieldbus) also causes **a transition to phase4**.

this means it possible, using commands

- **S-0-0127, C100 Communication phase 3 transition check**
- **S-0-0128, C200 Communication phase 4 transition check**

to switch from **parametrization into operating mode** with an active command communications (P-0-4086 = xx**1**b).

See also Function description: "Position Command Value Monitoring".

S-0-0128 - Attributes

Function:	Command	**Editability:**	P3
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0130, Probe value 1 positive edge

The drive uses the positive edge of the input signal from **S-0-0130, Probe value 1 positive edge**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-0200, Signal select probe 1** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe Input Feature".

S-0-0130 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0200	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0200	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0131, Probe value 1 negative edge

The drive uses the negative edge of the input signal from **S-0-0401, Probe 1**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-0200, Signal select probe 1** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe Input Feature".

S-0-0131 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0200	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0200	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0132, Probe value 2 positive edge

The drive uses the positive edge of the input signal from **S-0-0402, Probe 2**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-0201, Signal select probe 2** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe Input Feature".

S-0-0132 - Attributes

Function:	Parameter	**Editability:**	-
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0201	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0201	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0133, Probe value 2 negative edge

The drive uses the negative edge of the input signal from **S-0-0402, Probe 2**, to store the instantaneous value of the selected signal in this parameter.

The signal to be measured is determined by parameters **P-0-0201, Signal select probe 2** and **S-0-0169, Probe control parameter**.

See also the functional description: "Probe Input Feature".

S-0-0133 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0201	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0201	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0134, Master control word

The master control word is cyclically transmitted from the communications card (e.g., PBK2.1) to the controller card (EBC) with the command communication (SERCOS or fieldbus) is **active** (P-0-4086 = x1xb). Significant control information is defined herein such as

- drive ON and drive enable
- drive halt
- interpolator cycle
- command operating mode.

Note: The contents of **S-0-0134, Master control word** in fieldbus drives depends on the state fixed in parameter **P-0-4077, Fieldbus control word**. Parameter **S-0-0134, Master-control word** in this case only supports diagnostics.

Parameter structure:

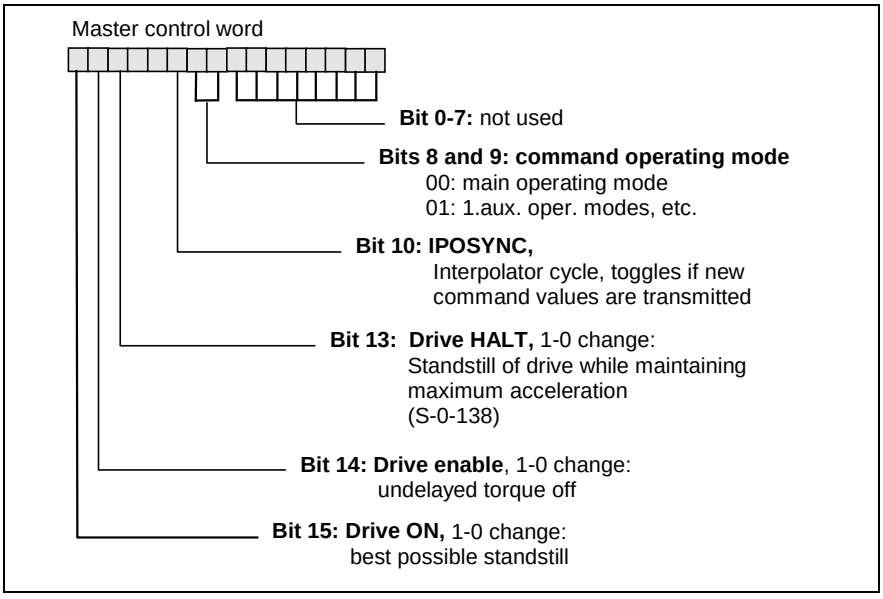

Master control word
Bit 0-7: not used
Bits 8 and 9: command operating mode
00: main operating mode
01: 1.aux. oper. modes, etc.
Bit 10: IPOSYNC,
Interpolator cycle, toggles if new command values are transmitted
Bit 13: Drive HALT, 1-0 change:
Standstill of drive while maintaining maximum acceleration
(S-0-138)
Bit 14: Drive enable, 1-0 change:
undelayed torque off
Bit 15: Drive ON, 1-0 change:
best possible standstill

Fig. 2-21:Structure of S-0-0134, Master control word

S-0-0134 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0135, Drive status word

The drive status word lists all important **status information**

- control and power sections ready to operate
- drive ock, error in C1D
- change bit status classes 2 and 3
- change bit command
- current operating mode

of the drive.

Note: The contents of **S-0-0135** in fieldbus drives depend on the state of the controller. The actual status information of the fieldbus is in parameter **P-0-4078**, **Fieldbus status word**. Parameter **S-0-0135, Drive status word** only supports diagnostics.

Parameter structure:

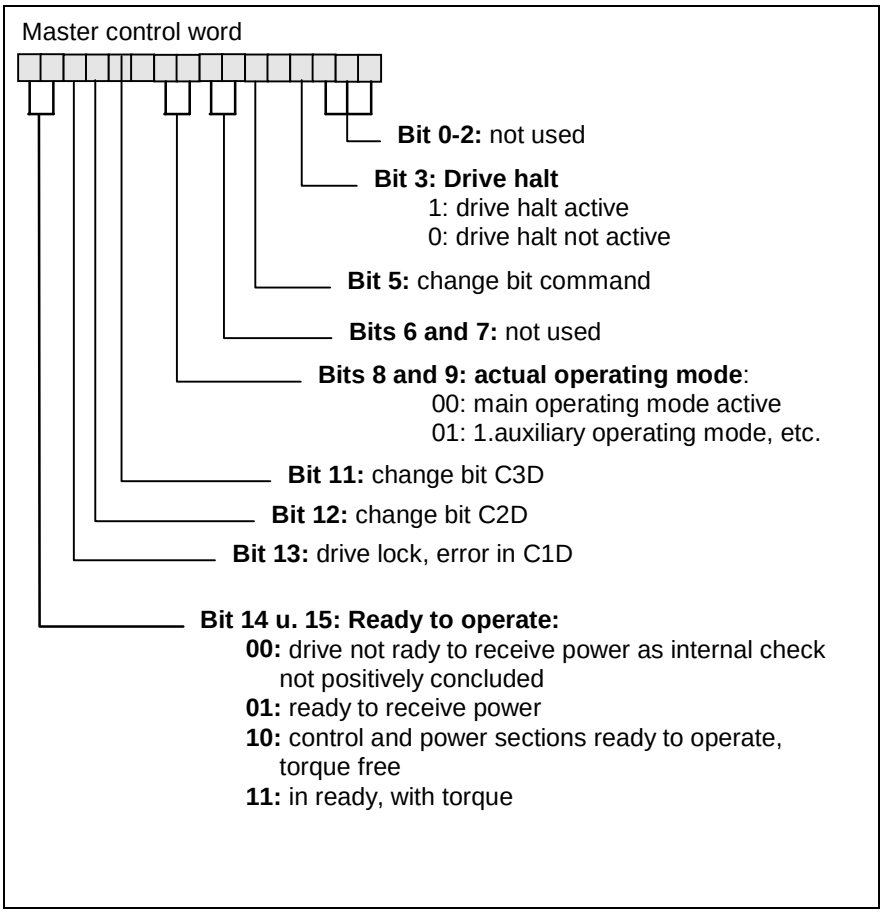

Master control word
Bit 0-2: not used
Bit 3: Drive halt
1: drive halt active
0: drive halt not active
Bit 5: change bit command
Bits 6 and 7: not used
Bits 8 and 9: actual operating mode:
00: main operating mode active
01: 1.auxiliary operating mode, etc.
Bit 11: change bit C3D
Bit 12: change bit C2D
Bit 13: drive lock, error in C1D
Bit 14 u. 15: Ready to operate:
00: drive not rady to receive power as internal check not positively concluded
01: ready to receive power
10: control and power sections ready to operate, torque free
11: in ready, with torque

Fig. 2-22:: Structure of S-0-0134, Master control word

S-0-0135 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0138, Bipolar acceleration limit value

The Bipolar acceleration limit value describes the maximum permissible acceleration, symmetrical in both directions (acceleration and deceleration).

The drive decelerates at this deceleration to the velocity = 0 when the function "Drive stop" is executed, if the previously active operation mode was without drive internal command generation. Operation modes without drive internal command generation are

- Position control
- Angular synchronization
- Stepper motor operation

and others.

See also the functional description: "Drive Halt".

S-0-0138 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / S-0-0160/278		
Default value:	100000	**Cyc. transmittable:**	no

S-0-0139, D700 Command Parking axis

Setting and enabling the command Parking Axis switches off all the monitoring functions related to the measurement system.

This affects position control, feedback monitoring and the monitoring of the position window (S-0-0057).

When the command is active, the drive does not report any errors of class 1 diagnostics.

The Position feedback value status (S-0-0403) is cleared by the drive.

The command is acknowledged positive, when the mentionend surveillances are switched off.

Clearing the command switches all the mentioned surveillances on again. To refer the position feedback values to the reference point again, the drive must go to the reference again.

Structure of the parameter:

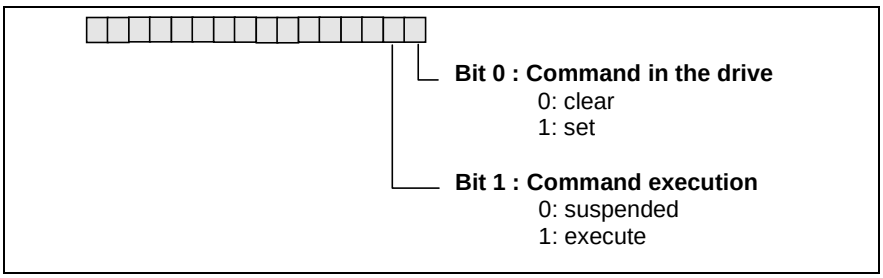


Fig. 2-23: S-0-0139, D700 Command Parking axis

See also the functional description: "Command Parking Axis".

S-0-0139 - Attributes

Function:	Command	**Editability:**	P2
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0140, Controller type

The device type of the manufacturer can be found in **text** form in the operating data for the controller type.

Examples:

HDS02.1-W100-D

DKC01.1-040-7

See also the functional description: "Drive Controllers and Motors".

S-0-0140 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	1Byte var.	**Memory:**	Verst. EE
Format:	ASCII	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0141, Motor type

Here is the motor type of the connected motor in text form.

The contents of the parametrer are overwritten when „Loading base values“ (possible with MHD, MKD and MKE motors) with parameter S-7-0141.

The diagnoses „F208 UL motor type has changed“ is based on a comparison between S-0-0141 and S-7-0141.

With motors without feedback data memory it is necessary to enter the motor type.

Example:

MKD 071B-061-KP1-BN

MKE 096B-047-GG0-KN

See also the functional description: "Systemoverview".

S-0-0141 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	1Byte var.	**Memory:**	Param. EE
Format:	ASCII	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	Default_Motor	**Cyc. transmittable:**	no

S-0-0142, Application type

A descriptive name text for the drive can be stored in this parameter (e.g., swivel axis). It has no functional significance.

See also the functional description: "Systemoverview"

S-0-0142 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	1Byte var.	**Memory:**	Param. EE
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	Default	**Cyc. transmittable:**	no

S-0-0144, Signal status word

With the help of the signal status word, real time signals can be transferred from the drive to the PLC.

To do so, the signal status word must be configured as cyclic data in the Drive Telegram.

The bits in the signal status word can be defined freely with the parameters **S-0-0026, Configuration list signal status word** and **S-0-0328, Config. list for signal status word, bit number** to P-0-4048=0xFFFE .

See also the functional description: "Configurable signal status word"

S-0-0144 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0145, Signal control word

With the help of the signal control word, signals can be transmitted in real time from control to drive.

The signal control word must, in this case, be built in as cyclical data into the drive telegram.

The bits in signal control word can be freely defined via parameter **S-0-0027, Configuration list signal control word** and **S-0-0329, Assign list signal control word.**

Also see function description: "Configurable signal control word"

S-0-0145 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0147, Homing parameter

The processes for the **S-0-0148, Drive controlled homing procedure,** in relation to the machine layout, NC and drive installation are set in this parameter.

Structure of the parameter:

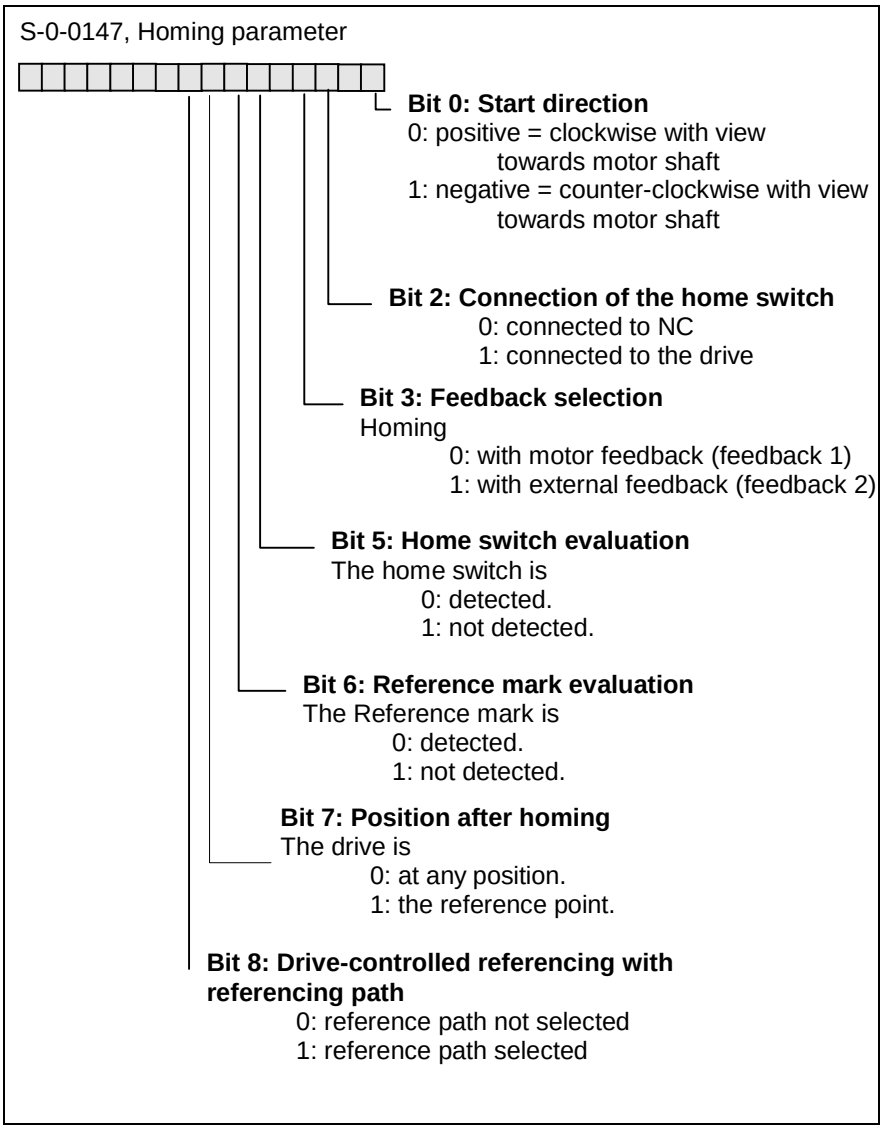

S-0-0147, Homing parameter
Bit 0: Start direction
0: positive = clockwise with view towards motor shaft
1: negative = counter-clockwise with view towards motor shaft
Bit 2: Connection of the home switch
0: connected to NC
1: connected to the drive
Bit 3: Feedback selection
Homing
0: with motor feedback (feedback 1)
1: with external feedback (feedback 2)
Bit 5: Home switch evaluation
The home switch is
0: detected.
1: not detected.
Bit 6: Reference mark evaluation
The Reference mark is
0: detected.
1: not detected.
Bit 7: Position after homing
The drive is
0: at any position.
1: the reference point.
Bit 8: Drive-controlled referencing with referencing path
0: reference path not selected
1: reference path selected

Fig. 2-24: S-0-0147, Homing Parameter

See also the functional description: "Drive-controlled homing".

S-0-0147 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0010 0000b	**Cyc. transmittable:**	no

S-0-0148, C600 Drive controlled homing procedure command

When this command is set and enabled, the drive switches automatically into internal position control and accelerates using the **S-0-0042, Homing acceleration** to the **S-0-0042, Homing velocity** as long as it is in operating status AF. Bit 0 in **S-0-0403, Position feedback value status** will be deleted at first. As long as the command is active, changes in the cyclic position command values will be ignored.

The process for the homing procedure can be specified with **S-0-0147, Homing parameter**. After the command has been properly executed (drive is at standstill and position feedback value is related to the homing position), the drive sets bit 0 in parameter **S-0-0403, Position feedback value status**.

The parameter "Position feedback value status“ reflects the signal "In_Reference“.

See also the functional description: "Drive-controlled homing"

S-0-0148 - Attributes

Function:	Command	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0150, Reference offset 1

This parameter describes the distance between the position encoder home reference marker 1 and **S-0-0052, Reference distance 1**.

The parameter makes it possible to shift the reference point in relation to the reference marker to be detected. If bit 7 in **S-0-0147, Homing parameter** is set to 1, then, during execution of the command **S-0-0148, C600 Drive controlled homing procedure command**, the drive goes to the reference point shifted from the reference mark by the value **S-0-0150, Reference Offset 1**.

See also the functional description: "Drive-controlled homing".

S-0-0150 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0151, Reference offset 2

This parameter describes the distance between the position encoder home reference marker 2 and **S-0-0054, Reference distance 2**.

The parameter makes it possible to shift the reference point in relation to the reference marker to be detected. If bit 7 in **S-0-0147, Homing parameter** is set to 1, then, during execution of the command **S-0-0148,**

C600 Drive controlled homing procedure command, the drive goes to the reference point shifted from the reference mark by the value **S-0-0151, Reference offset 2**.

See also the functional description: "Drive-controlled homing"

S-0-0151 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0157, Velocity window

The Velocity window refers to the absolute value of the **S-0-0036, Velocity Command Value**.

If the velocity command value is whithin the calculated velocity window, then the drive sets the bit 0 in **S-0-0013, Class 3 diagnostics** (Message 'n_actual = n_command').

See also the functional description: "S-0-0013, Class 3 Diagnostics"

S-0-0157 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Prog.-Modul
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0044		
Default value:	1000000	**Cyc. transmittable:**	no

S-0-0159, Monitoring window

When an operating mode with internal position control is activated in the drive, the position loop is monitored. Therefore, a model value for the actual position is calculated and compared with the real actual position.

The maximum tolerated deviation between the measured and calculated actual feedback value is set with the help of the parameter **S-0-0159, Monitoring window**. If the position deviation exceeds the monitoring window, then the drive sets the error **F228 Excessive deviation** in the class 1 diagnostics.

The greatest deviation that occurs will always be stored in parameter **P-0-0098, Max. model deviation**.

See also the functional description: "Position Control Loop Monitoring"

S-0-0159 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	1000000	**Cyc. transmittable:**	no

S-0-0160, Acceleration data scaling type

Various scaling types can be set as described below for the acceleration data in the drive as defined by the bit values of this parameter.

Structure of the parameter:

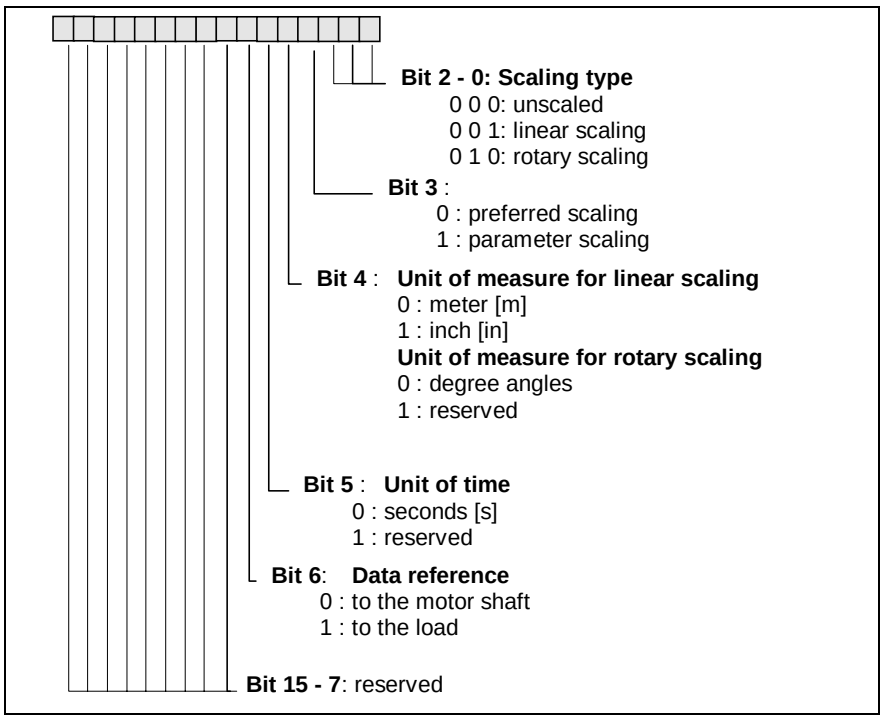

Bit 2 - 0: Scaling type
0 0 0: unscaled
0 0 1: linear scaling
0 1 0: rotary scaling
Bit 3 :
0 : preferred scaling
1 : parameter scaling
Bit 4 : Unit of measure for linear scaling
0 : meter [m]
1 : inch [in]
Unit of measure for rotary scaling
0 : degree angles
1 : reserved
Bit 5 : Unit of time
0 : seconds [s]
1 : reserved
Bit 6: Data reference
0 : to the motor shaft
1 : to the load
Bit 15 - 7: reserved

Fig. 2-25: S-0-0160, Acceleration Data Scaling Type

In bit 3 it is possible to select between preferred and parameter scaling.

Preferred scaling:

With preferred scaling, the following parameters are predefined and cannot be changed:

- **S-0-0161, Scaling factor for accel data**
- **S-0-0162, Scaling exponent for accel data**

Scaling with parameter scaling means that this parameter must be set

(See section: "Preferred / parameter scaling").

Note: Only the bits named here are supported by the product.
See also: **S-0-0044, Velocity data scaling type**

Example: (Acceleration data scaling)

Suppose that loadside, linear scaling as desired with acceleration units in M/s². The scaling on the drive will result as follows:

Parameter	Value
S-0-0159, Acceleration data scaling type	1001001
Bit 2-0 001 linear scaling	
Bit 3: 1 (Preferred) parameter scaling	
Bit 4: 0 Dimensional unit in meters (m)	
Bit 5: 0 Time unit in seconds (s)	
Bit 6: 1 Data referenced at load	

S-0-0161, Acceleration data scaling factor 1

S-0-0162, Acceleration data scaling exponent -6

Now suppose that the decimal value +1234567 is stored in the relevant acceleration data register. The datum value will be interpreted and displayed as:

or $+1234{,}567X10^{-3}$ mm/s^2

or, as the value would be displayed in the IDN lists, +1234,567 mm/s^2 with respect to the load.

Note that the least significant decimal value is determined by the scaling exponent, in this exaple, as 10^{-6} m/s^2 or 10^{-3} mm/s^2.

see also functional description: "Velocity Data Display Format"

S-0-0160 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0100 0010b	**Cyc. transmittable:**	no

S-0-0161, Acceleration data scaling factor

When parameter scaling is set in **S-0-0160, Acceleration data scaling type**, the scaling factor for all of the acceleration data in the drive is determined by this parameter.

See also the functional description: "Velocity Data Display Format".

S-0-0161 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 65535		
Default value:	1	**Cyc. transmittable:**	no

S-0-0162, Acceleration data scaling exponent

If parameter scaling is set in **S-0-0160, Acceleration data scaling type** the scaling exponent with sign for all acceleration data in the drive is determined in this parameter.

See also the functional description: "Velocity Data Display Format".

S-0-0162 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-32768 / 32768		
Default value:	-3	**Cyc. transmittable:**	no

S-0-0165, Distance coded reference offset 1

With the help of this parameter, the greater distance between two reference markers is programmed, if a measurement system with distance coded reference markers is used.

See also the functional description: "Drive-Controlled Homing"

S-0-0165 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Periods	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0166, Distance coded reference offset 2

With the help of this parameter, the smaller distance between two reference markers is programmed, if a measurement system with distance coded reference markers is used.

See also the functional description: "Drive-Controlled Homing"

S-0-0166 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Periods	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 4294967295		
Default value:	1000	**Cyc. transmittable:**	no

S-0-0169, Probe control parameter

This parameter is used to specify whether one or both of the probe inputs "probe 1" (DSS: X12-E4) and "probe 2" (DSS: X12-E5) are activated, and which edge (positive/negative) should trigger the probe data acquisition.

Parameter structure:

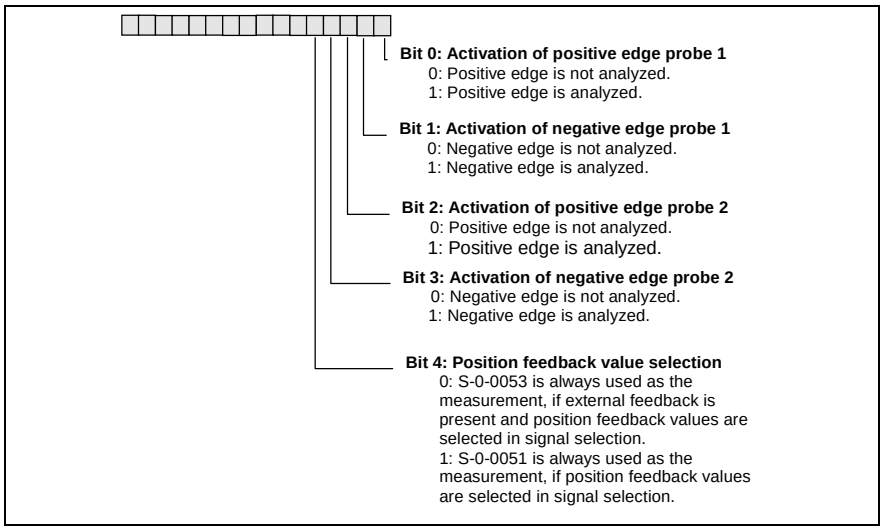

Bit 0: Activation of positive edge probe 1
0: Positive edge is not analyzed.
1: Positive edge is analyzed.
Bit 1: Activation of negative edge probe 1
0: Negative edge is not analyzed.
1: Negative edge is analyzed.
Bit 2: Activation of positive edge probe 2
0: Positive edge is not analyzed.
1: Positive edge is analyzed.
Bit 3: Activation of negative edge probe 2
0: Negative edge is not analyzed.
1: Negative edge is analyzed.
Bit 4: Position feedback value selection
0: S-0-0053 is always used as the measurement, if external feedback is present and position feedback values are selected in signal selection.
1: S-0-0051 is always used as the measurement, if position feedback values are selected in signal selection.

Fig. 2-26 S-0-0169, Probe control parameter

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Probe Input Feature".

S-0-0169 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0170, Probing cycle procedure command

By setting and enabling the command "probing cycle procedure," the drive reacts to the following:

- **S-0-0405, Probe 1 enable / S-0-0406, Probe 2 enable** and
- **S-0-0401, Probe 1, / S-0-0402, Probe 2.**

as is programmed in **S-0-0169, Probe control parameter**.

The NC can perform multiple measurements while this command is active. If the NC no longer wants new measurements, it clears the command.

Parameter structure:

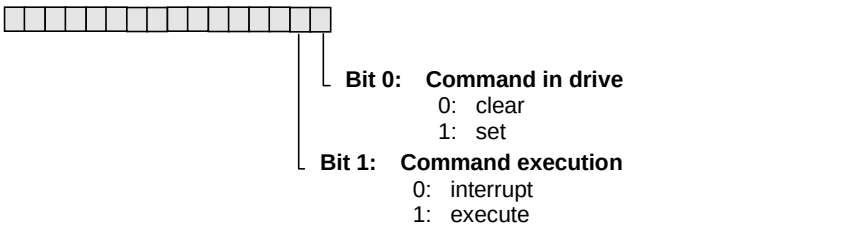


Fig. 2-27 S-0-0170, Probing cycle procedure command

Note: With bit 0, moreover, the monitoring of the external 24V is activated.

See also the functional description: "Probe Input Feature".

S-0-0170 - Attributes

Function:	Parameter	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0173, Marker position A

During the drive controlled homing with an incremental measuring system, the position of the reference marker (zero pulse) is stored in this parameter. This position feedback value still refers to the "old“ coordinate system (before switching the coordinate system with the homing procedure).

Furthermore, the recognition of the reference mark can be activated by the command **P-0-0014, D500 Command determine marker position**. Then, as soon as the next reference pulse comes from the feedback, the appropriate position value is stored in this parameter, and the command gets a positive acknowledge.

See also the functional description: "Command - detect marker position"

S-0-0173 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0177, Absolute distance 1

The parameter is used for the homing procedure of a distance coded motor feedback. It describes the offset between the zero point of the motor feedback (position of the 1st reference marker of the motor encoder) and the machine's zero-point.

Determining the right value for this parameter can be done in 2 steps. First, write the value 0 into S-0-0177 and proceed the command **S-0-0148, C600 Drive controlled homing procedure command**. The position feedback value 1 in S-0-0051 then shows the actual position refered to the machine’s zero point.

Then, when you jog the axis to the machine’s zero point, input the value of S-0-0051 indicated there into S-0-0177 with inverted sign (+ ↔ -). After another homing, the value in S-0-0051 displays the position in reference to the machine’s zero point.

See also the functional description: "Drive-Controlled Homing"

S-0-0177 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0178, Absolute distance 2

The parameter is used for the homing procedure of a distance coded external feedback. It describes the offset between the zero point of the optional feedback (position of the 1st reference marker) and the machine's zero-point.

Determining the right value for this parameter can be done in 2 steps. First, write the value 0 into S-0-0178 and proceed the command **S-0-0148, C600 Drive controlled homing procedure command**. The position feedback value 2 in S-0-0053 then shows the actual position refered to the machine’s zero point.

Then, when you jog the axis to the machine's zero point, input the value of S-0-0053 indicated there into S-0-0178 with inverted sign (+ ↔ -). After another homing, the value in S-0-0053 displays the position in reference to the machine's zero point.

See also the functional description: "Drive-Controlled Homing"

S-0-0178 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0179, Measurement value status

If the drive stores one or more measured values during the active **Command probe cycle** (**IDN 00170**) then it simultaneously sets the relevant bit in the measured value cycle.

If **Probe 1 enable** (**IDN 00405**) is cleared by the control, then the drive clears bits 0 and 1 in the probe status.

If **Probe 2 enable**(**IDN 00406**) is cleared by the control, then the drive clears bits 2 and 3 in the probe status.

The drive clears all bits if the command probe cycle (**IDN 00170**) is cleared by the control.

Parameter structure:

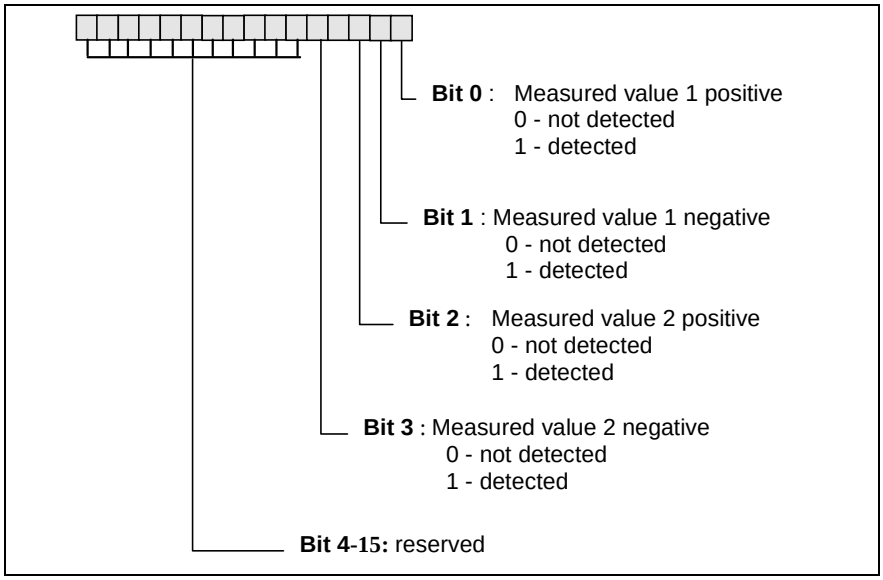

Bit 0 : Measured value 1 positive
0 - not detected
1 - detected
Bit 1 : Measured value 1 negative
0 - not detected
1 - detected
Bit 2 : Measured value 2 positive
0 - not detected
1 - detected
Bit 3 : Measured value 2 negative
0 - not detected
1 - detected
Bit 4-15: reserved

Fig. 2-28 Probe status structure

S-0-0179 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	AT

S-0-0182, Manufacturer class 3 diagnostics

Different messages regarding operating status will be stored here every 8ms. If the status of a message were to change, this would not be signalled by an editing bit.

Structure of the parameter:

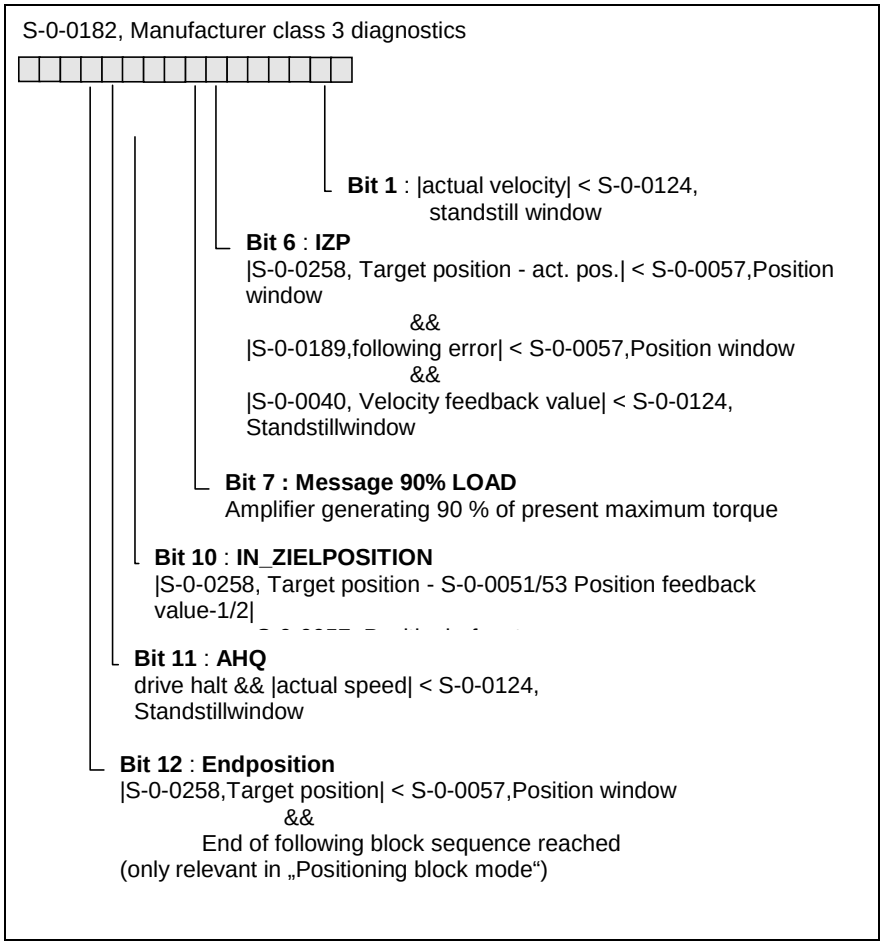

S-0-0182, Manufacturer class 3 diagnostics
Bit 1 : |actual velocity| < S-0-0124, standstill window
Bit 6 : IZP
|S-0-0258, Target position - act. pos.| < S-0-0057,Position window
&&
|S-0-0189,following error| < S-0-0057,Position window
&&
|S-0-0040, Velocity feedback value| < S-0-0124, Standstillwindow
Bit 7 : Message 90% LOAD
Amplifier generating 90 % of present maximum torque
Bit 10 : IN_ZIELPOSITION
|S-0-0258, Target position - S-0-0051/53 Position feedback value-1/2|
Bit 11 : AHQ
drive halt && |actual speed| < S-0-0124, Standstillwindow
Bit 12 : Endposition
|S-0-0258,Target position| < S-0-0057,Position window
&&
End of following block sequence reached
(only relevant in „Positioning block mode“)

Fig. 2-29 Structure of S-0-0013, Class 3 diagnostics

See also the functional description: "S-0-0182, Manufacturer class 3 diagnostics"

S-0-0182 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0185, Length of the configurable data record in the AT

In the operating data of the parameter with this ID number, the drive indicates the maximum length in bytes which it can process in the configurable Real time channel from drive to motor can be processed.

Note: In the actual version of the firmware, the number of data in the AT equals 16 bytes.

S-0-0185 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	constant
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0186, Length of the configurable data record in the MDT

In the operating data of the parameter with this ID number, the drive indicates the maximum length in bytes which it can process in the configurable data record of the Real time channel from master to drive.

Note: In the actual version of the firmware, the number of data in the AT equals 16 bytes.

S-0-0186 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	constant
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0187, List of configurable data in the AT

This list contains the ID numbers of the operating data which can be configured in real time data channel from slave to master in list P-0-4080, process data input description

- **S-0-0012, Class 2 diagnostics**
- **S-0-0013, Class 3 diagnostics**
- **S-0-0040, Velocity feedback value**
- **S-0-0051, Position feedback 1 value**
- **S-0-0053, Position feedback 2 value**
- **S-0-0080, Torque/Force command**
- **S-0-0084, Torque/Force feedback value**
- **S-0-0130, Probe value 1 positive edge**
- **S-0-0131, Probe value 1 negative edge**
- **S-0-0132, Probe value 2 positive edge**
- **S-0-0133, Probe value 2 negative edge**
- **S-0-0144, Signal status word**
- **S-0-0173, Marker position A**
- **S-0-0179, Measurement value status**
- **S-0-0182, Manufacturer class 3 diagnostics**
- **S-0-0189, Following error**
- **S-0-0364, AT Data container A**
- **S-0-0368, Addressing for data container A**

- **S-0-0390, Diagnostic message number**
- **P-0-0135, Status position switch**
- **P-0-0202, Difference probe values 1**
- **P-0-0203, Difference probe values 2**
- **P-0-0210, Analog input 1**
- **P-0-0211, Analog input 2**
- **P-0-0222, State of Travel range limit inputs**
- **P-0-0223, Status Input E-Stop function**
- **P-0-4051, Process block acquittance**
- **P-0-4076, Fieldbus container object**
- **P-0-4078, Fieldbus status word**
- **P-0-4086, Command communication status**

S-0-0187 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0188, List of configurable data in the MDT

This list contains the ID numbers of the operating data which can be configured in real time data channel from master to slave in list P-0-4081, process data output description.

- **S-0-0036, Velocity command value**
- **S-0-0037, Additive velocity command value**
- **S-0-0047, Position command value**
- **S-0-0080, Torque/Force command**
- **S-0-0091, Bipolar velocity limit value**
- **S-0-0092, Bipolar torque/force limit value**
- **S-0-0108, Feedrate override**
- **S-0-0145, Signal control word**
- **S-0-0193, Positioning Jerk**
- **S-0-0258, Target position**
- **S-0-0259, Positioning Velocity**
- **S-0-0260, Positioning Acceleration**
- **S-0-0282, Travel distance**
- **S-0-0346, Setup flag for relative command values**
- **S-0-0360, MDT Data container A**
- **S-0-0362, List index, MDT data container A**
- **S-0-0366, List index, AT data container A**
- **S-0-0368, Addressing for data container A**
- **S-0-0393, Command value mode**

- **P-0-0132, Switch on threshold position switch**
- **P-0-0133, Switch off threshold position switch**
- **P-0-0139, Analog output 1**
- **P-0-0140, Analog output 2**
- **P-0-4006, Process block target position**
- **P-0-4007, Process block velocity**
- **P-0-4008, Process block acceleration**
- **P-0-4009, Process block jerk**
- **P-0-4019, Process block mode**
- **P-0-4026, Process block selection**
- **P-0-4030, Jog velocity**
- **P-0-4056, Jog inputs**
- **P-0-4060, Process block control word**
- **P-0-4076, Fieldbus container object**
- **P-0-4077, Fieldbus control word**

S-0-0188 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0189, Following error

To this parameter, the drive writes the current **difference between the position command and the feedback position** value (**S-0-0051, Position feedback 1 value** or **S-0-0053, Position feedback 2 value**).

See also the functional description: "Determining the position controller setting".

S-0-0189 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

S-0-0191, D600 Cancel reference point procedure command

Setting and enabling the command Cancel reference point clears the bit **S-0-0403, Position feedback value status** in the drive.

The command correctly completed in the drive, when the bit "Position feedback value status“ has been set to 0 and the position value of the

active feedback does not refer any more to the machine's zero point (= no longer referenced).

Parameter structure:

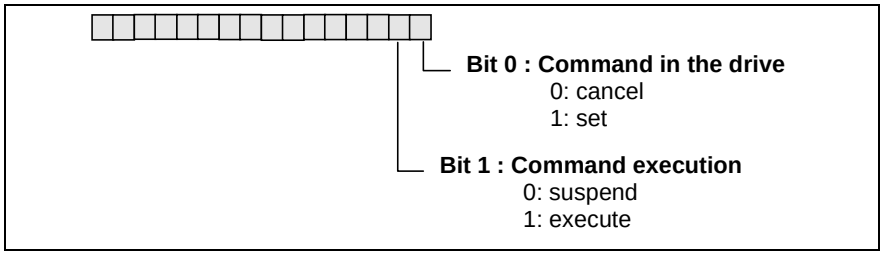


Fig. 2-30 S-0-0191, D600 Cancel reference point procedure command

See also the functional description: "Drive-Controlled Homing"

S-0-0191 - Attributes

Function:	Command	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0192, IDN-list of backup operation data

The ID numbers for all operating data that must be loaded in the drive for proper operation are kept in this IDN list. Generally these are the parameters which are stored in the programming module.

The control system should use this IDN list to create a **backup** copy of the drive parameters.

See also the functional description: "IDN List of Parameters".

S-0-0192 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0193, Positioning Jerk

The positioning jerk limits the acceleration change per time in the operating modes with

- Drive internal interpolation and
- Relative drive internal interpolation.
- type

Note: With the value 0, the jerk filter is off.

See also the functional description: "Function principle: Drive Internal Interpolation"

S-0-0193 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / 4000000.000		
Default value:	0	**Cyc. transmittable:**	MDT

S-0-0201, Motor warning temperature

If the motor temperature exceeds the motor warning temperature, then the motor warning high temperature bit will be set by the drive in **S-0-0012, Class 2 diagnostics**.

This parameter will be set by the drive at **145°** for MHD, MKD and MKE motors.

See also the functional description: "Temperature monitoring".

S-0-0201 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	C	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	45.0 / S-0-0204		
Default value:	1400	**Cyc. transmittable:**	no

S-0-0204, Motor shutdown temperature

If the motor temperature exceeds the motor shutdown temperature, then the motor overtemperature bit in **S-0-0011, Class 1 diagnostics** will be set by the drive and the error **F219 Motor overtemp. shutdown** will be generated.

In MHD, MKD and MKE motors, the drive sets this parameter at **155°.**

See also the functional description: "Temperature monitoring".

S-0-0204 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	C	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	S-0-0201 / 155.0		
Default value:	1500	**Cyc. transmittable:**	no

S-0-0256, Multiplication 1

The parameter S-0-0256, Multiplication 1 determines, with which factor the signals of the motor feedback are multiplied in the drive.

The internal **resolution** for the motor encoder in the drive is calculated as follows:

S-0-0116 Resolution of motor feedback • S-0-0256 Multiplication 1

The multiplication 1 depends at first from the parameters **S-0-0278, Maximum travel range** and **S-0-0116, Resolution of motor feedback**. If there is an optional encoder, the **S-0-0257, Multiplication 2** is taken into account as well.

See also the functional description: "Setting the drive-internal position data format"

S-0-0256 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	1	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0257, Multiplication 2

The parameter **S-0-0257, Multiplication 2** determines, with which factor the signals of the optional feedback are multiplied in the drive.

The internal resolution for the optional encoder in the drive is calculated as follows:

S-0-0117 Resolution of optional feedback • S-0-0257 Multiplication 2

The multiplication 2 depends on the parameters **S-0-0278, Maximum travel range** and **S-0-0117, Resolution of optional feedback**.

See also the functional description: "Setting the drive-internal position data format"

S-0-0257 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	1	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0258, Target position

The target position is assigned to the drive as a command value by the controller in the operating modes with drive-controlled interpolation. The drive moves to the target position taking into account **S-0-0259, Positioning Velocity**, **S-0-0260, Positioning Acceleration** and **S-0-0193, Positioning Jerk**

Note: In the operating mode "Position control with positioning interface" (process blocks), the target position of the current position block will be copied to parameter **S-0-0258, target position**.

See also the functional description: "Function principle: Drive Internal Interpolation"

S-0-0258 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0259, Positioning Velocity

Using the positioning velocity

- it is possible in operating mode with drive-internal interpolation to run to S-0-0258, target position
- and to limit velocity if "run with limited speed" is switched on in positioning block mode
- or to set the effective speed with an automatic control loop setting.

See also the functional description: "Function principle: Drive Internal Interpolation".

S-0-0259 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / S-0-0044		
Default value:	100000	**Cyc. transmittable:**	MDT

S-0-0260, Positioning Acceleration

Positioning acceleration is used in the "Drive internal interpolation" operating mode to accelerate up to the **S-0-0259, Positioning velocity**.

The acceleration active in control loop settings is also set with this parameter.

See also the functional description: "Function principle: Drive Internal Interpolation"

S-0-0260 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / S-0-0160/278		
Default value:	100000	**Cyc. transmittable:**	MDT

S-0-0262, C700 Command basic load

When this command is set and enabled, the default parameters in the motor feedback for current, velocity and position control loop settings will be loaded and activated. These default parameters are not optimized for the specific application. They establish a stable control loop status.



ATTENTION

⇒ When this command is executed, parameters that have already been optimized may be overwritten.

See also Function description: "Load Default Feature"

S-0-0262 - Attributes

Function:	Command	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0265, Language selection

All parameter names, units and diagnostic warning messages within the drive controller are stored in several languages. This parameter determines the output language for the text.

- 0: German
- 1: English
- 2: French
- 3: Spanish
- 4: Italian

See also the functional description: "Language selection".

S-0-0265 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 4		
Default value:	0	**Cyc. transmittable:**	no

S-0-0267, Password

With this parameter, a customer password can be activated. This is used to lock the writability of all important parameters specific for the axis. The parameters which are locked by activating the customer password, can be seen in the parameter **S-0-0192, IDN-List of backup operation data**.

The password "007" is set at the factory. This password permits write access to the parameters.

Moreover, the parameter can unlock service capabilities.

See also the functional description: "Password".

S-0-0267 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	1Byte	**Memory:**	no
Format:	ASCII	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0269, Parameter buffer mode

Note: Parameter **S-0-0269** is not significant as all parameters are stored in a non-volatile memory (NOVRAM)!

S-0-0269 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1		
Default value:	---	**Cyc. transmittable:**	no

S-0-0277, Position feedback 1 type

This parameter is used to determine the significant properties of the encoder 1.

Parameter structure:

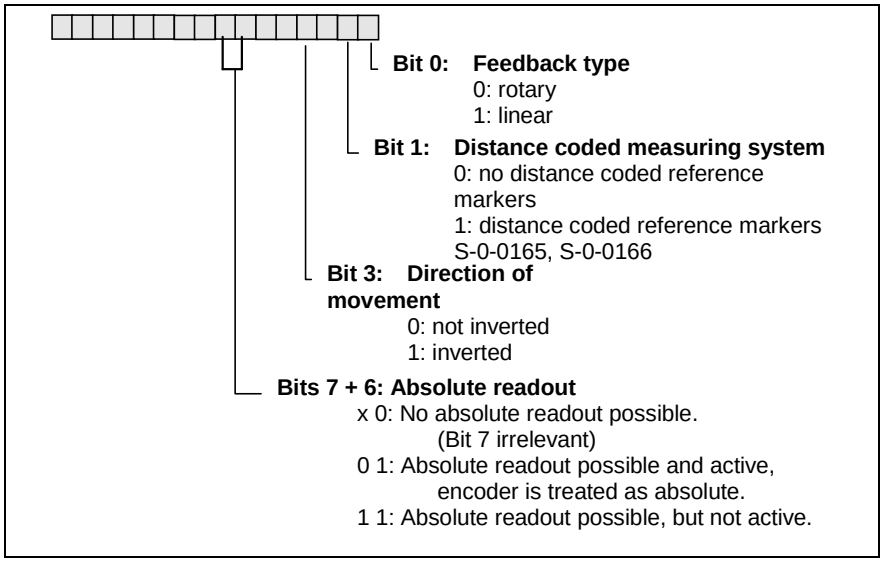

Bit 0: Feedback type
0: rotary
1: linear
Bit 1: Distance coded measuring system
0: no distance coded reference markers
1: distance coded reference markers S-0-0165, S-0-0166
Bit 3: Direction of movement
0: not inverted
1: inverted
Bits 7 + 6: Absolute readout
x 0: No absolute readout possible. (Bit 7 irrelevant)
0 1: Absolute readout possible and active, encoder is treated as absolute.
1 1: Absolute readout possible, but not active.

Fig. 2-31 S-0-0277, Position feedback 1 type parameter

Remark:

- If the motor has a motor feedback memory (MHD, MKD or MKE) then bits 0,1 and 3 are deleted.
- If the motor is a linear motor, then bit 0 is set to "1“.
- Depending on the absolute encoder range and the maximum travel range or modulo value, bit 6 is either set or deleted.

Note: Only the bits indicated here are supported by the software.

See also the functional description: "Other Motor Encoder Characteristics"

S-0-0277 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

S-0-0278, Maximum travel range

The parameter **S-0-0278, Maximum travel range** defines the maximum possible mechanical move of the machine. Depending on the selected scaling, modulo or absolute format (see also **S-0-0076, Position data scaling type**), the input is unipolar (positive only) or bipolar (with sign).

The parameter **S-0-0278, Maximum travel range** affects the parameters **S-0-0256, Multiplication 1** and **S-0-0257, Multiplication 2** and therefore the internal position resolution in the drive.

Moreover, the limits for velocity and acceleration of the drive internal position command generator are influenced by the maximum travel range. Among others, the max. input values for **S-0-0259, Positioning Velocity** and **S-0-0260, Positioning Acceleration** depend from the value in S-0-0278 !

Note: The greater the parametrized maximum travel range, the smaller is the multiplication and the drive internal position resolution and the higher are the limits of the acceleration and velocity data.

Additionally, the parameter **S-0-0278, Maximum travel range** affects the bit 6 "Absolute readout possible“ in the respective parameter **S-0-0277, Position feedback 1 type** or **S-0-0115, Position feedback 2 type**. If the parametrized maximum travel range is greater than the absolute numerical range of the used encoder, then the bit 6 for "Absolute readout possible“ is reset to 0. Vice versa, the bit 6 is set as soon as a travel range less than the absolute numerical range of the encoder is recognized.

See also the functional description: "Setting the drive-internal position data format"

S-0-0278 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / 214748.3647		
Default value:	2147483647	**Cyc. transmittable:**	no

S-0-0279, IDN-list of password-protected operation data

The parameters in the IDN list are write protected with a user password (**S-0-0267, Password)**.

The user can select those parameters to be protected by editing the parameters.

The state of the parameters at delivery corresponds to the contents of parameter **S-0-0279, IDN-list of password-protected operation data**.

See also functional description: "Password

S-0-0279 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	Param.-E²prom
Format:	IDN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	-- / --		
Default value:	S-0-0192	**Cyc. transmittable:**	no

S-0-0282, Travel distance

The control gives to the drive the travel distance in the operating mode **Relative internal Interpolation** as a **relative command value**.

When the parameter **S-0-0346, Setup flag for relative command values** is toggled (= changed), the drive adds the travel distance to the target position. The resulting absolute target position is displayed in in the parameter **S-0-0258, Target position**. Then, the drive performs the travel distance, with regard to

- **S-0-0259, Positioning Velocity**
- **S-0-0260, Positioning Acceleration**
- **S-0-0193, Positioning Jerk**

See also the functional description: "Mode: Relative drive-internal interpolation"

S-0-0282 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	-
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0292, List of all operating modes

In this list, all operation modes are named, which the drive supports. The operation modes are listed by their codings, as they are input in the parameters **S-0-0032..35** (primary and secondary operation modes).

Contents S-0-0292:

Bit list:	Meaning:
0000,0000,0000,0001	Torque control
0000,0000,0000,0010	Velocity control
0000,0000,0000,x011	Position control with encoder 1
0000,0000,0000,x100	Position control with encoder 2
0000,0000,0001,x011	Drive-controlled interpolation, encoder 1
0000,0000,0001,x100	Drive-controlled interpolation, encoder 2
1100,0000,0001,0011	Jog-Mode
0000,0010,0011,x011	Position control with process blocks, encoder 1
0000,0010,0011,x100	Position control with process blocks, encoder 2

The following applies for bit 3:

Bit 3 = 0 position control with following error

Bit 3 = 1 position control without following error

See also the functional description: "Possible Operating Modes".

S-0-0292 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-- / --		
Default value:	---	**Cyc. transmittable:**	no

S-0-0298, Reference cam shift

For the drive controlled homing, if there is more than one reference marker in the travel range of the axis during homing, it is necessary to evaluate a reference switch. In this case, the 0->1 rising edge of the zero switch specifies the relevant reference marker.

To do this, the distance between zero switch and reference marker may not be below a certain value, because otherwise the reference marker is ambiguous. Therefore, the drive monitors the distance. If the distance is outside the allowed range, the command **S-0-0148, C600 Drive controlled homing procedure command** ends up with the error **C602 Distance zero switch - reference marker wrong**.

In this case, this parameter shows the distance, by which the zero switch must be shifted, to get the optimal distance.

You can either

- input the value in the parameter **S-0-0299, Home switch offset** to shift the active zero switch (virtually) referred to the real one, or
- shift the zero switch mechanically by the value displayed in S-0-0298.

If the distance between zero switch and reference marker is good, then **S-0-0298, Reference cam shift by**.. displays a 0.

See also the functional description: "Drive-Controlled Homing"

S-0-0298 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0299, Home switch offset

For the drive controlled homing, if there is more than one reference marker in the travel range of the axis during homing, it is necessary to evaluate a reference switch. In this case, the 0->1 rising edge of the zero switch specifies the relevant reference marker.

To do this, the distance between zero switch and reference marker may not be below a certain value, because otherwise the reference marker is ambiguous. Therefore, the drive monitors the distance. If the distance is outside the allowed range, the command **S-0-0148, C600 Drive controlled homing procedure command** ends up with the error **C602 Distance zero switch - reference marker wrong**.

In this case, the parameter **S-0-0298, Reference cam shift** shows the distance, by which the zero switch must be shifted, to get the optimal distance.

You can either

- input the value in the parameter **S-0-0299, Home switch offset** to shift the active zero switch (virtually) referred to the real one, or
- shift the zero switch mechanically by the value displayed in S-0-0298.

If the distance between zero switch and reference marker is good, then S-0-0298, Reference cam shift by.. displays a 0.

See also the functional description: "Drive-Controlled Homing"

S-0-0299 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0328, Assign list signal status word

The signal status word (S-0-0144) is configured with the parameters **S-0-0026, Configuration list signal status word** and **S-0-0328, Assign list signal status word**. These parameters have variable length with data elements of 16 bits. In the parameter **S-0-0026, Configuration list signal status word**, the **ident number** of the parameters is set, which contains the original bit (source). The parameter **S-0-0026, Configuration list signal status** determines, which **bit** in the data is copied into the signal status word.

The position in the respective configuration list determines, to which position in the signal status word the chosen bit is copied.

See also the functional description: "Configurable signal status word".

S-0-0328 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	0	**Cyc. transmittable:**	no

S-0-0329, Assign list signal control word

The signal control word (S-0-0145) is configured with the parameters **S-0-0027, Configuration list signal control word** and **S-0-0329, Assign list signal control word**. These parameters have variable length with data elements of 16 bits.

In the Parameter **S-0-0027, Configuration list signal control word**, the **ident number** of the parameter is set which contains the bit to manupulate (target). In the Parameter **S-0-0329, Assign list signal control word**, it is set which **bit** in the data of that ident number is manipulated by the signal control word.

The position in the respective configuration list determines the bit assignment in the signal control word.

See also the functional description: "Configurable signal control word".

S-0-0329 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	-
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0346, Setup flag for relative command values

In "Positioning block mode" any toggling of bit 0 of S-0-0346 causes the selected travel block to be assumed.

In I/O mode (**P-4084, Profile type** = FF8xh) parameter S-0-0346 is used by the "profile interpreter" on the communiations card for selecting a travel block. Parameter S-0-0346 does not have to be externally manipulated!

S-0-0346 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1		
Default value:	---	**Cyc. transmittable:**	MDT

S-0-0347, Speed deviation

Parameter S-0-0347 indicates the difference between the velocity command value and the velocity feedback value in the velocity controller.

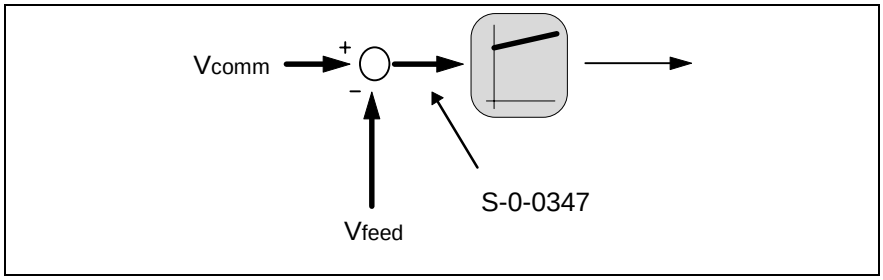


Fig. 2-32 S-0-0347, Speed deviation

See also the functional description: "Velocity controller".

S-0-0347 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0044	**Extrem value check:**	no
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0348, Acceleration feedforward gain

The acceleration feedforward helps to reduce the following error during the acceleration in operation modes without following error. To do this, the current acceleration command value is multiplied by the "acceleration feedforward gain" and added to the current command value of the velocity controller.

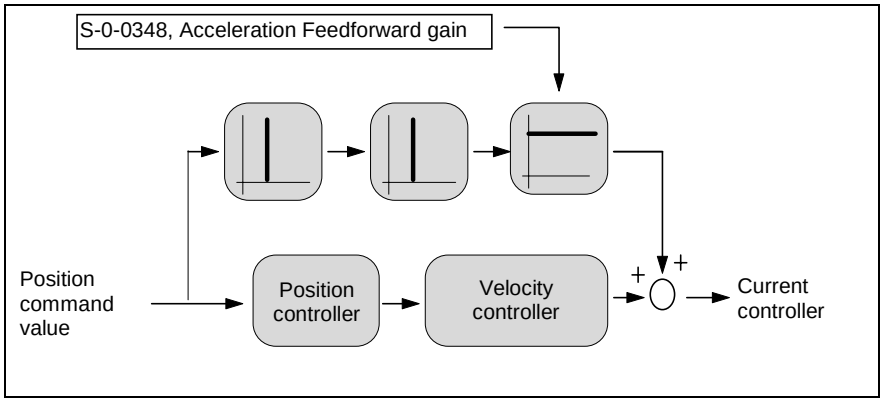


Fig. 2-33 Acceleration feedforward

Activation:

Writing a value greater than 0 to the parameter activates the acceleration feedforward.

Note: The controller functions as well without feedforward! (The standard value equals 0.) Acceleration feedforward is only possible in lagless modes (without following error).

Comparison between the different types of feedforward

The **velocity feedforward** is activated by selecting an operating mode without **lag** (following error). This creates (from the point of view of the position controller) a **feedforward of 1st order** (prop. to velocity). This means that at constant speed, the position deviation is 0. A lag results, nevertheless, during acceleration and deceleration.

The **acceleration feedforward** is activated by entering more than 0 for this parameter. It creates (from the point of view of the position controller), a **feedforward of 2nd order** (prop. to acceleration). The position deviation is 0 as long as the correct gain is set and the acceleration is constant.

Correct input value:

$$S\text{-}0\text{-}0348 = \frac{\text{moment of inertia } \left(\text{kgm}^2\right)}{\text{torque constant } \left(\text{Nm/A}\right)} * 1000$$

The moment of inertia is the total sum of the rotor and the reflected load inertia.

The factor 1000 is needed for unit mA.

Fig. 2-34 Acceleration feedforward prop. gain

See also the functional description: "Setting the Acceleration Feed Forward"

S-0-0348 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	mA/(rad/s²)	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 6553.5		
Default value:	0	**Cyc. transmittable:**	no

S-0-0349, Jerk limit bipolar

The Jerk limit bipolar limits the **acceleration change per time** during "Drive Halt"

See also the functional description: "Drive Halt"

S-0-0349 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 4000000.000		
Default value:	0	**Cyc. transmittable:**	MDT

S-0-0360, MDT Data container A

Note: Parameter S-0-0360, MDT data container A is used for the implementation of a multiplexed data exchange (multiplex channel) between the communications and drive processors.

S-0-0360 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0362, List index, MDT data container A

Note: Parameter S-0-0362, list index MDT data container A is used for the implementation of a multiplexed data exchange (multiplex channel) between the communications and drive processors.

S-0-0362 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	HEX	**Validity check:**	no
Unit:		**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0364, AT Data container A

Note: Parameter S-0-0364, AT data container A is used for the implementation of a multiplexed data exchange (multilex channel) between the communications and drive processors.

S-0-0364 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0366, List index, AT data container A

Note: Parameter S-0-0366, list index AT data container A is used for the implementation of a multiplexed data exchange (multiplex channel) between the communications and drive processors.

S-0-0366 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	HEX	**Validity check:**	no
Unit:		**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0368, Addressing for data container A

Note: Parameter S-0-0368, addressing data container A is used for the implementation of a mutliplexed data exchange (multiplex channel) between the communications and drive processors.

S-0-0368 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	HEX	**Validity check:**	-
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0370, Configuration list for MDT data container

Note: Parameter S-0-0370, configuration list MDT data container is used for the implementation of a mutliplexed data exchange (multiplex channel) between the communications and drive processor.

S-0-0370 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	-
Unit:	--	**Extrem value check:**	-
Decimal places:	0	**Combination check:**	-
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0371, Configuration list for the AT data container

Note: Parameter S-0-0371, configuration list AT data container, is used for the implementation of a multiplexed data exchange (multiplex channel) between the communication and drive processor.

S-0-0371 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	-
Unit:	--	**Extrem value check:**	-
Decimal places:	0	**Combination check:**	-
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0375, List of diagnostic numbers

The drive enters every change of the parameter **S-0-0390 Diagnostic number** in this list. The list is organized as a circular buffer; there is place for 50 numbers. When the list is read, the 1st element of the parameter shows the last displayed diagnostic number.

See also the functional description: "List of diagnostic numbers"

S-0-0375 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	no
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

S-0-0378, Encoder 1, absolute range

Parameter **S-0-0378 Absolute encoder 1, range** defines the range in which the encoder selected in **P-0-0074, Feedback type 1** can generate the position information absolutely.

Also see Function Description: "Absolute encoder range and absolute encoder evaluation"

S-0-0378 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	---	**Cyc. transmittable:**	no

S-0-0379, Encoder 2, absolute range

Description:

Parameter **S-0-0379, Absolute encoder 2, range**defines the range in which the encoder selected in **P-0-0075, Feedback type 2**can generate the position information absolutely.

Also see function description: "Absolute encoder range and absolute encoder evaluation".

S-0-0379 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	---	**Cyc. transmittable:**	no

S-0-0382, Intermediate bus power

Display of the DC-bus power in kw.

S-0-0382 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	KW	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0383, Motor temperature

This parameter contains the measured motor temperature.

Remark:

For all motors except 2AD motors, a PTC resistor is used as the temperature sensor .

As the temperature curve in this case shows a considerable tolerance and in higher temperature ranges a considerable progression, the value in
S-0-0383, Motor temperature is not usable for these motor types.

See also the functional description: "Temperature monitoring".

S-0-0383 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	C	**Extrem value check:**	no
Decimal places:	1	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0390, Diagnostic message number

In the parameter Diagnostic message number, the same number is stored as it can be seen in the seven segment display. This makes it possible for the control to generate its own diagnostics according to the diagnostic message number (for example in languages which are not stored as diagnostics in the drive).

Example:

Diagnostic Message: "F822 Motor encoder failure: signal too small" in parameter S-0-0095

Seven Segment Display: changing "F8" <=> "22"

Diagnostic message number: "F822(hex)" in parameter S-0-0390

See also the functional description: "Diagnostic Message Number"

S-0-0390 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0391, Monitoring window feedback 2

Description:

This parameter defines the maximum allowable deviation of the **S-0-0051, Actual feedback 1 value** and **S-0-0053, Actual feedback 2 value.**

If this value is exceeded for longer than 20ms, then the error **F236, Excessive position feedback difference** will be generated.

The monitoring can be turned off by writing 0 to this parameter.

See also the functional description: "Actual feedback value monitoring".

S-0-0391 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:		**Memory:**	Param. EE
Format:		**Validity check:**	Phase3
Unit:		**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

S-0-0393, Command value mode

Structure of the parameter:

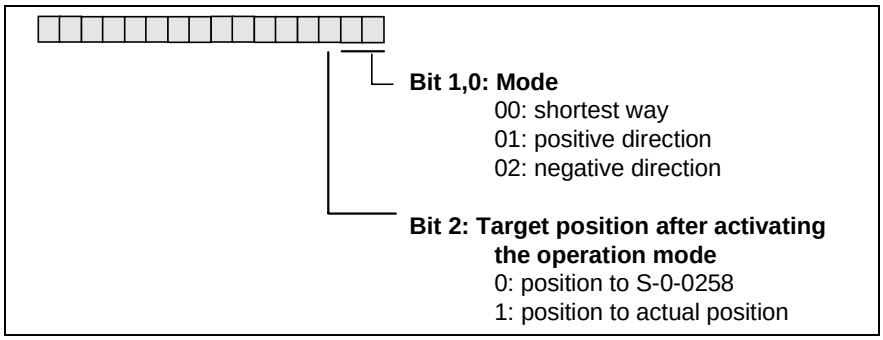

Bit 1,0: Mode
00: shortest way
01: positive direction
02: negative direction
Bit 2: Target position after activating the operation mode
0: position to S-0-0258
1: position to actual position

Fig. 2-35 Structure of the parameter S-0-0393

Description of Bit 1:

The interpretation of position command values such as **S-0-0047, Position command value** and **S-0-0258, Target position** with activated modulo function is dependent on the selected mode. To adjust the mode, there is the parameter S-0-0393.

This parameter has an effect only if **S-0-0076, Position data scaling type** has been activated in the modulo format.

Description of Bit 2:

Parameter S-0-0393, Command value mode, Bit 2 = 0

After activation, the drive positions to the value in the parameter S-0-0258 Target position. So, after an interruption of the operation mode (e.g. on error), the drive can go to the same target position as it should have done before the error. That means, the **remaining path** is performed. **Reference dimension** is retained.

Parameter S-0-0393, Command value mode, Bit 2 = 1

After activating the operation mode, the drive refers the distance to move always to the actual position. To do this, the parameter S-0-0258, Target position is set to the actual position. That means, after an accidental interruption, the drive stays at the actual position at first.

In the operation mode Relative drive internal interpolation, the distance to move refers to the actual position after toggling the parameter S-0-0346 Setup flag for relative command values. In other words, after a possible interrupt, the drive remains standing on the actual position value.

See also the functional description: "Processing Command Values in Modulo Format, Shortest Path - Direction Selection".

S-0-0393 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 2		
Default value:	0	**Cyc. transmittable:**	no

S-0-0399, IDN list of configurable data in the signal control word

To configure the signal control word, you must enter the ident numbers of the parameters in the "Assign list signal control word". In the parameter **S-0-0399 IDN list of configurable data in the signal control word**, you can read which parameters can be entered there.

Contents S-0-0399:

- **S-0-0000, Zero-Parameter to switch off**
- **S-0-0148, C600 Drive controlled homing procedure command**
- **S-0-0149, D400 Positive stop drive procedure command**
- **S-0-0152, C900 Position spindle command**
- **S-0-0169, Probe control parameter**
- **S-0-0170, Probing cycle procedure command**
- **S-0-0191, D600 Cancel reference point procedure command**
- **S-0-0346, Setup flag for relative command values**
- **S-0-0405, Probe 1 enable**
- **S-0-0406, Probe 2 enable**

- **P-0-0012, C300 Command 'Set absolute measurement'**
- **P-0-0014, D500 Command determine marker position**
- **P-0-0036, Trigger control word**
- **P-0-4026, Process block selection**
- **P-0-4056, Jog inputs**
- **P-0-4060, Process block control word**

See also the functional description: "Configuring the Signal Control Word"

S-0-0399 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-0-0400, Home switch

This parameter is used to assign an ID number to the home switch (external signal).

Structure of the parameter:

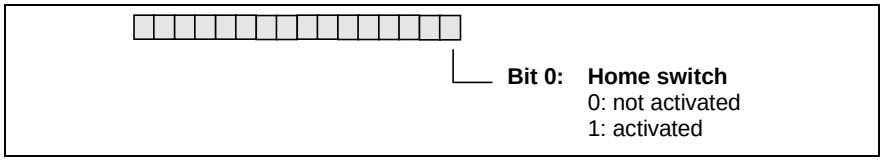


Fig. 2-1: S-0-0400, Home switch

See also the functional description: "Evaluation of the Home Switch"

S-0-0400 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0401, Probe 1

This parameter is used to assign an ID number to Probe 1 (external signal). This makes it possible to assign Probe 1 to a real-time status bit, for example.

The signal Probe 1 is only polled by the drive and considered valid if the **S-0-0170, Probing cycle procedure command** is active and **S-0-0405, Probe 1 enable** is present.

Parameter structure:

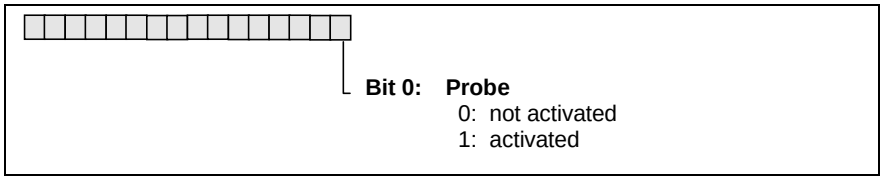


Fig. 2-36 S-0-0401, Probe 1

See also the functional description: "Probe Input Feature".

S-0-0401 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0402, Probe 2

This parameter is used to assign an ID number to Probe 2 (external signal). This makes it possible to assign Probe 2 to a real-time status bit, for example.

The signal Probe 2 is only polled by the drive and considered valid if the **S-0-0170, Probing cycle procedure command** is active and **S-0-0406, Probe 2 enable** is present.

Parameter structure:

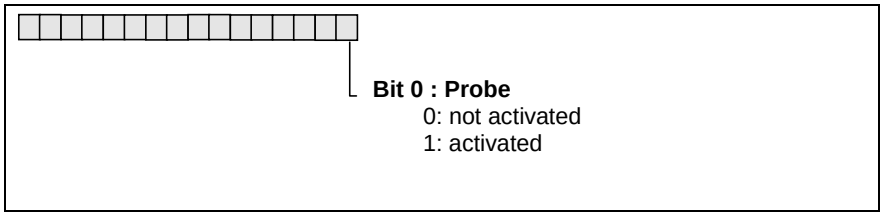


Fig. 2-37 S-0-0402, Probe 2

See also the functional description: "Probe Input Feature".

S-0-0402 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0403, Position feedback value status

When the bit 3 of **S-0-0147, Homing parameter** is set high, bit 0 of this parameter will be set high when the position feedback value is fixed in feference to the machine's zero point.

When the drive performs the commands **S-0-0148, C600 Drive controlled homing** procedure or **P-0-0012, C300 Command 'Set**

absolute measurement', the bit will be reset when they are started and then set 1 again once the command has been successfully completed.

The bit position feedback value status corresponds to the output signal "In reference".

In drives with Sercos interface, the position feedback value status can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Structure of the parameter:

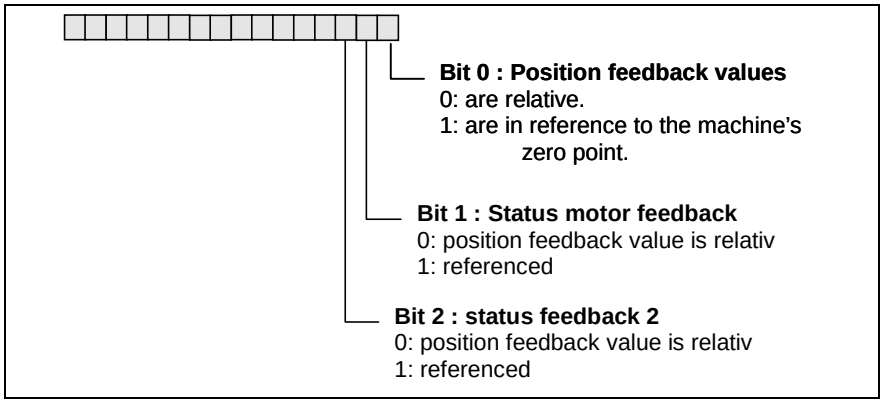

Bit 0 : Position feedback values
0: are relative.
1: are in reference to the machine's zero point.
Bit 1 : Status motor feedback
0: position feedback value is relativ
1: referenced
Bit 2 : status feedback 2
0: position feedback value is relativ
1: referenced

Fig. 2-38 S-0-0403, Position feedback value status

See also the functional description: "Drive-controlled homing".

S-0-0403 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0405, Probe 1 enable

This parameter is used to enable a probe input.

Changing this signal from 0 to 1 activates the trigger mechanism for evaluating the positive and/or negative slope of the probe signal.

The probe 1 enable can be assigned to a real-time control bit and thus be communicated to the master control word in the drive.

Parameter structure:

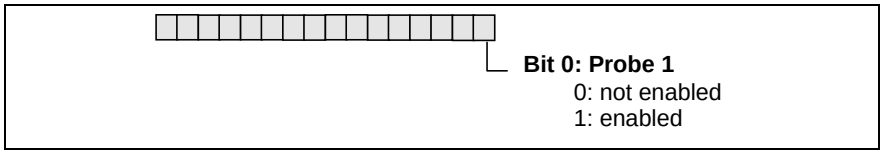


Fig. 2-39 S-0-0405, Probe 1 enable

See also the functional description: "Probe Input Feature".

S-0-0405 - Attributes

Function:	Parameter	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no

Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0406, Probe 2 enable

This parameter is used to enable a probe input.

Changing this signal from 0 to 1 activates the trigger mechanism for evaluating the positive and/or negative slope of the probe signal.

The probe 2 enable can be assigned to a real-time control bit and thus be communicated to the drive in the master control word.

Parameter structure:

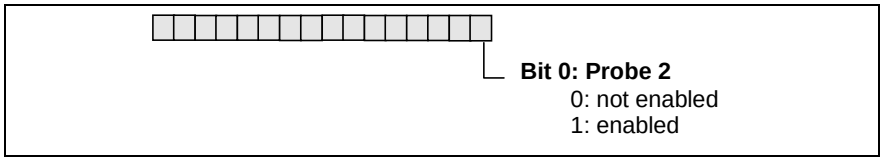


Fig. 2-40 S-0-0406, Probe 2 enable

See also the functional description: "Probe Input Feature".

S-0-0406 - Attributes

Function:	Parameter	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0409, Probe 1 positive latched

Bit 0 in this parameter will be set by the drive if

- the **S-0-0170, Probing cycle procedure command** is active,
- bit 0 in **S-0-0169, Probe control parameter** is set,
- **S-0-0405, Probe 1 enable** is present and
- the positive edge of **S-0-0401, Probe 1** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0130, Probe value 1 positive edge**.

The drive clears the bit if the NC clears the **S-0-0170, Probing cycle procedure command** or if **S-0-0405, Probe 1 enable** has been set from 1 to 0.

The parameter "Probe 1 positive latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

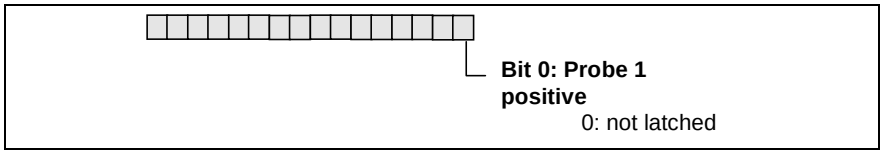


Fig. 2-41 S-0-0409, Probe 1 positive latched

See also the functional description: "Probe Input Feature".

S-0-0409 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0410, Probe 1 negative latched

Bit 0 in this parameter will be set by the drive if

- the **S-0-0170, Probing cycle procedure command** is active,
- bit 1 in **S-0-0169, Probe control parameter** is set,
- **S-0-0405, Probe 1 enable** is present and
- the negative edge of **S-0-0401, Probe 1** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0131, Probe value 1 negative edge**.

The drive clears the bit if the NC clears the **S-0-0170, Probing cycle procedure command** or if **S-0-0405, Probe 1 enable** has been set from 1 to 0.

The parameter "probe 1 negative latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

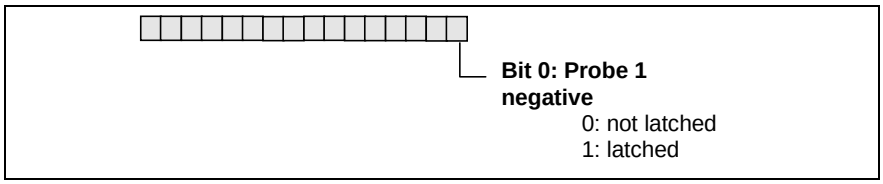


Fig. 2-42 S-0-0410, Probe 1 negative latched

See also the functional description: "Probe Input Feature".

S-0-0410 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0411, Probe 2 positive latched

Bit 0 in this parameter will be set by the drive if

- the **S-0-0170, Probing cycle procedure command** is active,
- bit 3 in **S-0-0169, Probe control parameter** is set,
- **S-0-0406, Probe 2 enable** is present, and
- the positive edge of **S-0-0402, Probe 2** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0132, Probe value 2 positive edge**.

The drive clears the bit if the NC clears the **S-0-0170, Probing cycle procedure command** or if **S-0-0406, Probe 2 enable** has been set from 1 to 0.

The parameter "Probe 2 positive latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

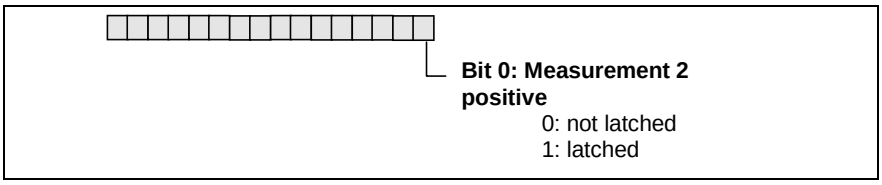


Fig. 2-43 S-0-0411, Probe 2 positive latched

See also the functional description: "Probe Input Feature".

S-0-0411 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-0-0412, Probe 2 negative latched

Description:

Bit 0 in this parameter will be set by the drive if

- the **S-0-0170, Probing cycle procedure command** is active,
- bit 3 in **S-0-0169, Probe control parameter** is set,
- **S-0-0406, Probe 2 enable** is present, and
- the negative edge of **S-0-0402, Probe 2** is recognized.

The drive simultaneously stores the value of the selected signal in **S-0-0133, Probe value 2 negative edge**.

The drive clears the bit if the NC clears the **S-0-0170, Probing cycle procedure command** or if **S-0-0406, Probe 2 enable** is set from 1 to 0.

The parameter "probe 2 negative latched" can be assigned to a real-time status bit and thus be continuously communicated to the NC in the drive status word (see **S-0-0305, Allocation of real-time status bit 1**).

Parameter structure:

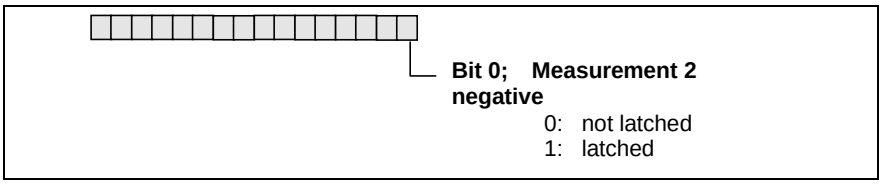


Fig. 2-44 S-0-0412, Probe 2 negative latched

See also the functional description: "Probe Input Feature".

S-0-0412 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-7-0100, Velocity loop proportional gain

This parameter contains the default value for the velocity loop proportional gain.

This value comes from the feedback data memory. With the Basic Load procedure, the S-7-xxxx parameters are copied into the S-0-xxxx parameters.

Note: S-0-0100 and S-7-0100 have different units/dimensions, e.g. for rotatory action As/rad vs. mAs/rad. The number of places after the decimal also differs.

See also the functional description: "Setting the velocity controller" and the parameter description for S-0-0100.

S-7-0100 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	mAs/rad	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-7-0101, Velocity loop integral action time

This parameter contains the default value for the integral action time of the integrator in the velocity loop controller.

This value comes from the feedback data memory. With the Basic Load procedure, the S-7-xxxx parameters are copied into the S-0-xxxx parameters.

See also the functional description: "Setting the velocity controller" and the parameter description for S-0-0101.

S-7-0101 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-7-0104, Position loop Kv-factor

This parameter contains the default value for the proportional gain of the position controller.

This value comes from the feedback data memory. With the Basic Load procedure, the S-7-xxxx parameters are copied into the S-0-xxxx parameters.

See also the functional description: "Setting the position controller" and the parameter description for S-0-0104.

S-7-0104 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	1000/min	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-7-0106, Current loop proportional gain 1

This parameter contains the appropriate value for the proportional gain of the current controller with the connected motor.

This value comes from the feedback data memory. With the Basic Load procedure, the S-7-xxxx parameters are copied into the S-0-xxxx parameters.

Note: Do not alter the values for the current controller set at the factory.

See also function description: "Setting the Current Controller" and the parameter description for S-0-0106.

S-7-0106 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	V/A	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-7-0107, Current loop integral action time 1

This parameter contains the appropriate value for the integral action time of the integrator in the current controller with the connected motor.

This value comes from the feedback data memory. With the Basic Load procedure, the S-7-xxxx parameters are copied into the S-0-xxxx parameters.

Note: Do not alter the values for the current controller set at the factory.

See also function description: "Setting the Current Controller" and the parameter description for S-0-0107.

S-7-0107 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

S-7-0109, Motor peak current

Value in the feedback memory which specifies the maximum current which may flow in the motor for a short period without damaging it.

For MHD, MKD and MKE motors, the value will be copied into the active parameter **S-0-0109, Motor peak current** when the amplifier is turned on.

See also the functional description: "Setting the Active Peak Current"

S-7-0109 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	A	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	---	**Cyc. transmittable:**	no

S-7-0111, Motor current at standstill

Value in the feedback memory for the current which can continuously flow in the motor without damaging it.

For MHD, MKD and MKE motors, the value will be copied into the active parameter **S-0-0111, Motor current** at standstill when the amplifier is turned on.

See also the functional description: "Motor Feedback-Data Memory"

S-7-0111 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	A	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	0.001 / 500.000		
Default value:	---	**Cyc. transmittable:**	no

S-7-0113, Maximum motor speed (nmax)

Value in the feedback memory for the maximum possible motor speed.

For MHD, MKD and MKE motors, the value will be copied into the active parameter **S-0-0113, Maximum motor speed (nmax)** when the amplifier is turned on.

See also the functional description: "Limiting Velocity".

S-7-0113 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	0 / 214738.3647		
Default value:	---	**Cyc. transmittable:**	no

S-7-0116, Feedback 1 Resolution

Value in the feedback memory for resolution of the motor encoder.

For MHD, MKD and MKE motors, the value will be copied into the active parameter **S-0-0116, Feedback 1 Resolution** when the amplifier is turned on.

See also the functional description: "Motor encoder resolution".

S-7-0116 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	Cycles/Rev	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-7-0117, Feedback 2 Resolution

Value in the feedback memory for resolution of the motor encoder.

The value will be copied into the active parameter **S-0-0117, Feedback 2 Resolution** when the amplifier is turned on.

See also the functional description: "Motor encoder resolution".

S-7-0117 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedback-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	Cycles/Rev	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

S-7-0141, Motor type

Text in the feedback memory for the motor type.

For MHD, MKD and MKE motors, the value will be copied into the active parameter S-0-0141, Motor type when the amplifier is turned on.

The diagnostic message „F208 UL motor type has changed“ is based on a comparison between S-0-0141 and S-7-0141.

Examples:

MKD 071B-061-KP1-BN

MKE 096B-047-GG0-KN

See also the functional description: "Drive Controllers and Motors"

S-7-0141 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	1Byte var.	**Memory:**	Feedb. EE
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

3 Product- specific parameters

P-0-0004, Velocity loop smoothing time constant

The time constant that can be activated in this parameter affects the output of the velocity loop controller. It can be used to suppress quantization effects and limit the bandwidth of the velocity loop controller.The limit frequency is derived from smoothing time constant T resulting from the relationship

$$f_g = \frac{1}{2 \cdot \pi \cdot \mathrm{T}}$$

Inputting the minimum input value turns the filter off.

See also the functional description: "Setting the velocity controller".

P-0-0004 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	500 / 65500		
Default value:	500	**Cyc. transmittable:**	no

P-0-0008, Activation E-Stop function

Parameter P-0-0008 can be used to activate the E-Stop input and to select a response for bringing the drive to standstill.

Parameter structure:

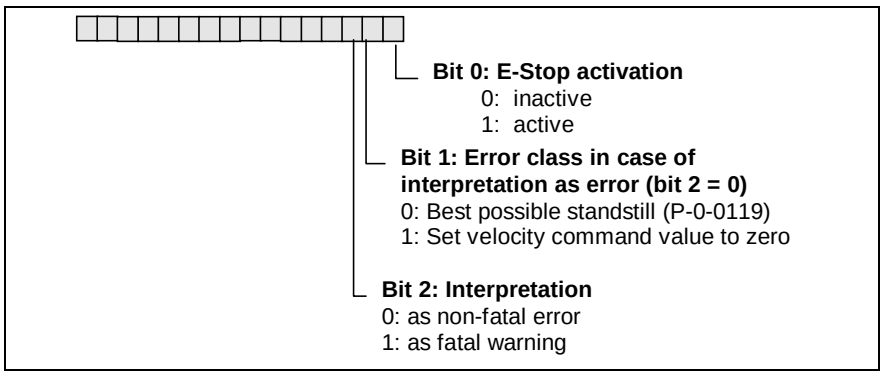

Bit 0: E-Stop activation
0: inactive
1: active
Bit 1: Error class in case of interpretation as error (bit 2 = 0)
0: Best possible standstill (P-0-0119)
1: Set velocity command value to zero
Bit 2: Interpretation
0: as non-fatal error
1: as fatal warning

Fig. 3-1: P-0-0008, Activation of E-Stop function

Note: The input polarity is always 0-active.

See also the functional description: "Activation and polarity of the E-Stop input".

P-0-0008 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0009, Error message number

If the drive diagnosis a class 1 diagnostic error, then a bit gets in parameter **S-0-0011, Class 1 diagnostics**. Bit 13 is set in the operation status word for ‘’Error in class 1 diagnostic’’.

Additionally, for a precise diagnosis,

- the diagnosis number is displayed in the 7-segment display and stored in parameter **S-0-0390, Diagnostic message number,**
- the plain text diagnosis is stored in parameter **S-0-0095, Diagnostic message**
- and the relevant error number is stored in **paramter P-0-0009, Error message number**.

If no error is pending, then the value of parameter **P-0-0009 Error message number** is 0.

Example for a diagnostic:

S-0-0390 F822 (hex)

P-0-0009: 822 (decimal)

S-0-0095: F822 Motor encoder failure: signal too small

7-segment display: Changing between F8 and 22

See also the functional description: "Error number".

P-0-0009 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0010, Excessive position command value

In position control mode (S-0-0032..35 = 0x0003, 0x0004, 0x000B or 0x000C), the NC sets position commands at constant intervals (all **S-0-0001, NC Cycle time (TNcyc)**). Within the drive, the difference of two sequential position commands are monitored for excessive values, i.e., the position commands must satisfy:

$$\frac{X_{Soll}(k) - X_{Soll}(k-1)}{S-0-0001} \leq S-0-0091$$

whereby:
Xsoll(k) = NC position command in current cycle
Xsoll(k-1) = NC position command in previous cycle
S-0-0091, Bipolar velocity limit value
S-0-0001, NC Cycle time (TNcyc)

Fig. 3-2: Monitoring of the position command for excessive values for in the position control mode

If the above condition is violated, then error **F237, Excessive position command difference** is triggered and the drive decelerantes as set in parameter **P-0-0119, Best possible decleration**.

The error triggering excessive position command value ($X_{soll}(k)$)is stored in parameter **P-0-0010, Excessive position command value**, the last

valid position command ($X_{soll}(k-1)$) in parameter **P-0-0011, Last valid position command value**.

See also the functional description: "Position command value monitoring".

P-0-0010 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0011, Last valid position command value

In position control mode (S-0-0032..35 = 0x0003, 0x0004, 0x000B or 0x000C), the NC sets position commands at constant intervals (every **S-0-0001, NC Cycle time TNcyc**). The difference of two sequential position commands is monitored for excessive value. The position command values must satisfy the following relation:

$$\frac{X_{Com}(k) - X_{Com}(k-1)}{S-0-0001} \leq S-0-0091$$

whereby:
Xcom(k) = NC-position command in current cycle
Xcom(k-1) = NC-position command in previous cycle
S-0-0091, Bipolar velocity limit value
S-0-0001, NC Cycle time (TNcyc)

Fig. 3-3: Monitoring of the position command for excessive values in the position control mode

If the above condition is violated, then error **F237, Excessive position command difference** is triggered, and the drive decelerates as set in parameter **P-0-0119, Best possible decleration**.

The error triggering excessive position command value $X_{Com}(k)$ is stored in parameter **P-0-0010, Excessive position command value**, the last valid position command $X_{Com}(k-1)$ in parameter **P-0-0011, Last valid position command value**.

See also the functional description: "Position command value monitoring".

P-0-0011 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0012, C300 Command 'Set absolute measurement'

When an absolute measuring system is started for the first time, the drive will indicate a random feedback value that is not referenced to the machine zero-point.

The position feedback of this measuring system can be set to the desired value with the command "Set absolute measurement". After the "Set absolute measurement" command is executed, the position feedback value of the measurement-supplied encoder will contain a defined reference to the machine zero-point. Thereafter, the value of parameter **S-0-0403, Position feedback value status** is 1.

All information will be available after reset because all necessary data from the absolute measurement system is buffered in feedback data memory or in parameter data memory. The position feedback value permanently retains its reference to the machine zero-point.

Parameter P-0-0012 can be used to execute this function.

See also the functional description: "Set absolute measuring".

P-0-0012 - Attributes

Function:	Command	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0014, D500 Command determine marker position

The command **P-0-0014, D500 Command determine marker position** is used to check the detection of the reference marker of an incremental measuring system. If there is an incremental measuring system and the command has been activated, then the actual position of the measuring system, once detected is stored in parameter **S-0-0173, Marker position A**. It is then signalled that the command is completed. Given 2 measuring systems,the bit 3 in **S-0-0147, Homing parameter** determines which measuring system is used.

See also the functional description: "Command - detect marker position"

P-0-0014 - Attributes

Function:	Command	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 3		
Default value:	0	**Cyc. transmittable:**	no

P-0-0015, Memory address

This parameter can be used to select a memory address in the drive for operation-internal test purposes. The contents will be displayed in the parameter **P-0-0016, Content of memory address**.

P-0-0015 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 0x1000000		
Default value:	0x8000	**Cyc. transmittable:**	no

P-0-0016, Content of memory address

This parameter displays the contents of the memory address set in parameter **P-0-0015, Memory address** (only for test purposes).

P-0-0016 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0018, Number of pole pairs/pole pair distance

This indicates the **number of pole pairs** per motor revolution **for rotating motors**.

For **linear motors**, the **length of a pole pair** must be indicated here.

This value does not need to be indicated here for motors with **motor feedback data memory**, like MKD.

See also the functional description: "Motor Feedback-Data Memory".

P-0-0018 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	pairs of poles/mm	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	3	**Cyc. transmittable:**	no

P-0-0019, Position start value

The position start value sets a defined initialization value for position feedback values 1 and 2 in non-absolute measurement systems.

During initialization of the position feedback value with command **S-0-0128, C200 Communication phase 4 transition check**, the drive checks whether the position start value has been written in communications phase 2 or 3. Only then will position feedback values 1 and 2 be set to that value. The position start value is used only for non-absolute encoders.

To preset the actual position value of the drive, the parameter P-0-0019, Position start value is used.

See also the functional description: "Actual Feedback Values of Non-Absolute Measurement Systems After Initialization".

P-0-0019 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	no
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	-2147483648 / 2147483647		
Default value:	0	**Cyc. transmittable:**	no

P-0-0021, List of scope data 1

The measured values of channel 1 of the oscilloscope function are stored in chronological sequence in parameter **P-0-0022, List of scope data 2**. (The oldest scope value is the first element of the list.)

See also the functional description: "Oscilloscope Feature".

P-0-0021 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	P-0-0023	**Validity check:**	no
Unit:	P-0-0023	**Extrem value check:**	no
Decimal places:	P-0-0023	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0022, List of scope data 2

The measured values of channel 2 of the oscilloscope function are stored in chronological sequence in parameter **P-0-0022, List of scope data 2**. (The oldest scope value is the first element of the list.)

See also the functional description: "Oscilloscope Feature".

P-0-0022 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	P-0-0024	**Validity check:**	no
Unit:	P-0-0024	**Extrem value check:**	no
Decimal places:	P-0-0024	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0023, Signal select scope channel 1

Parameter P-0-0023 determines the signal that will be recorded.

The following fixed predefined signals are available:

Number	Signal selection	Unit of the scope data list
0 x 00	Channel not activated	--
0 x 01	Actual feedback value dependent on operating mode S-0-0051 or S-0-0053	Dependent on position scaling
0 x 02	Velocity value parameter (S-0-0040)	Dependent on velocity scaling
0 x 03	Velocity control deviation (-S-0-0347)	Dependent on velocity scaling
0 x 04	Following error parameter (S-0-0189)	Dependent on position scaling
0 x 05	Torque/force command value parameter S-0-0080	Percent
0 x 06	Position feedback 1, S-0-0051	Dependent on position scaling
0 x 07	Position feedback 2, S-0-0053	Dependent on position scaling
0 x 08	Position command value	Dependent on position scaling

Fig. 3-4: P-0-0023, Signal select scope channel 1

Expanded oscilloscope recording feature:

In addition to the fixed predefined signal selection, it is also possible to record any memory address of the drive. To do this, bit 12 = 1 must be set. Bit 13 defines the data length of the memory signal in question.

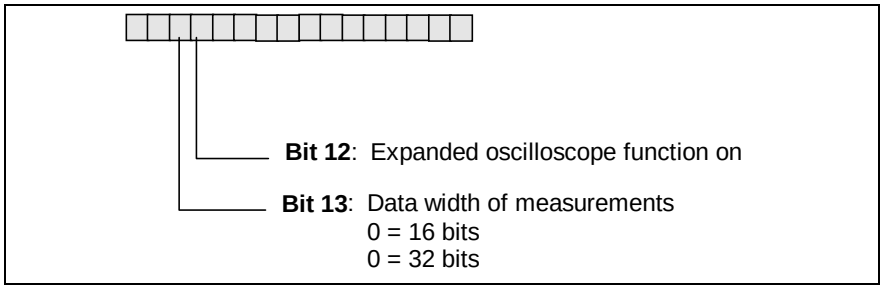


Fig. 3-5: P-0-0023 & P-0-0024, Oscilloscope function signal selection

See also the functional description: "Oscilloscope Feature".

P-0-0023 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 0xffff		
Default value:	0	**Cyc. transmittable:**	no

P-0-0024, Signal select scope channel 2

Parameter P-0-0024 determines the signal that will be recorded.

The following fixed predefined signals are available:

Number	Signal selection	Unit of the scope data list
0 x 00	Channel not activated	--
0 x 01	Actual feedback value dependent on operating mode S-0-0051 or S-0-0053	Dependent on position scaling
0 x 02	Velocity value parameter (S-0-0040)	Dependent on velocity scaling
0 x 03	Velocity control deviation (-S-0-0347)	Dependent on velocity scaling
0 x 04	Following error parameter (S-0-0189)	Dependent on position scaling
0 x 05	Torque/force command value parameter S-0-0080	Percent
0 x 06	Position feedback 1, S-0-0051	Dependent on position scaling
0 x 07	Position feedback 2, S-0-0053	Dependent on position scaling
0 x 08	Position command value	Dependent on position scaling

Fig. 3-6: P-0-0024, Signal select scope channel 2

Expanded oscilloscope recording feature:

In addition to the fixed predefined signal selection, it is also possible to record any memory address of the drive. To do this, bit 12 = 1 must be set. Bit 13 defines the data length of the memory signal in question.

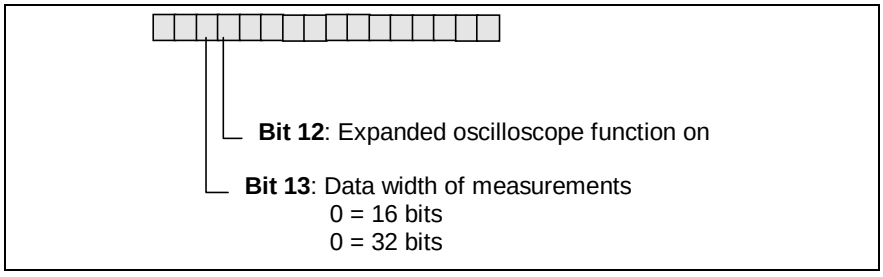


Fig. 3-7: P-0-0023, and P-0-0024, Oscilloscope function signal selection

See also the functional description: "Oscilloscope Feature".

P-0-0024 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 0xffff		
Default value:	0	**Cyc. transmittable:**	no

P-0-0025, Trigger source

Parameter P-0-0025 defines the source that initiates the trigger signal. There is a choice between

- External trigger
- Internal trigger

External trigger (P-0-0025 = 0x01)

If the external trigger is chosen, then the trigger will be initiated by bit 0 of the trigger command word.

Internal trigger (P-0-0025 = 0x02)

If the internal trigger is selected, then the trigger signal set by parameter will be monitored for the trigger condition, and the trigger will be initiated as soon as the condition is met.

See also the functional description: "Oscilloscope Feature".

P-0-0025 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 2		
Default value:	2	**Cyc. transmittable:**	no

P-0-0026, Trigger signal selection

For internal trigger sources, the parameter P-0-0026, Trigger signal selection defines the signal that is monitored for the parametrized trigger condition. The following fixed predefined signals are available:

Trigger signal numbers	Trigger signal	Corresponding trigger threshold
0 x 00	Not defined	Not defined
0 x 01	Actual feedback value based on mode of operation	Position data P-0-0027
0 x 02	Velocity feedback value Parameter S-0-0040	Velocity data P-0-0028
0 x 03	Velocity deviation parameter --	Velocity data P-0-0028
0 x 04	Following error, parameter S-0-0189	Position data P-0-0027
0 x 05	Torque command value, parameter S-0-0080	Torque data P-0-0029
0 x 06	Position feedback 1, S-0-0051	Depending on position scaling
0 x 07	Position feedback 2, S-0-0053	Depending on position scaling
0 x 08	Position command value	Depending on position scaling

Fig. 3-8: P-0-0026, Trigger signal selection

Additional trigger signals can also be defined by setting bit 12.

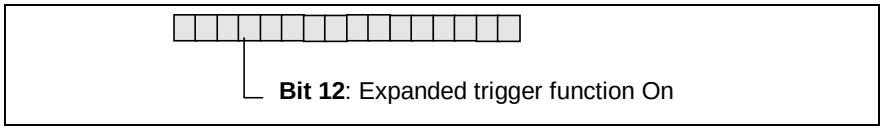


Fig. 3-9: P-0-0026, Trigger signal selection

See also the functional description: "Oscilloscope Feature".

P-0-0026 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 0x5		
Default value:	1	**Cyc. transmittable:**	no

P-0-0027, Trigger level for position data

Parameter P-0-0027 determines with given **P-0-0026, Trigger signal selection** oscilloscope function = “1“or “4“, the position value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope Feature".

P-0-0027 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0028, Trigger level for velocity data

Parameter P-0-0028 determines with given **P-0-0026, Trigger signal selection** oscilloscope function = “2“ or “3“, the actual speed value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope Feature".

P-0-0028 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	0	**Cyc. transmittable:**	no

P-0-0029, Trigger level for torque/force data

Parameter P-0-0029 determines with given **P-0-0026, Trigger signal selection** oscilloscope function = “5“, the torque force value at which the trigger will be released as long as the correct edge has been recognized.

See also the functional description: "Oscilloscope Feature".

P-0-0029 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	%	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	S-0-0086 / S-0-0086		
Default value:	0	**Cyc. transmittable:**	no

P-0-0030, Trigger edge

Parameter P-0-0030 Trigger edge defines the signal change at which a trigger event can be initiated.

Number:	Trigger edge:
1	Triggering on the positive edge of the trigger signal
2	Triggering on the negative edge of the trigger signal
3	Triggering on both the positive edge and negative edge of the trigger signal
4	Triggering if the trigger signal equals the trigger level

Fig. 3-10: Selection of trigger edges

See also the functional description: "Oscilloscope Feature".

P-0-0030 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 4		
Default value:	3	**Cyc. transmittable:**	no

P-0-0031, Timebase

The Timebase defines the time intervals in which the probe values of the selected signals are sampled. Possible time intervals range from 250 µs (resp. 500 µs) to 100 ms.

Note that in general:

Recording duration = Time resolution • Size of memory [µs]

See also the functional description: "Oscilloscope Feature".

P-0-0031 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	500 / 100000		
Default value:	500	**Cyc. transmittable:**	no

P-0-0032, Size of memory

The size of memory determines the number of recorded probe values per measurement. A maximum of 512 probe values can be recorded per channel.

The memory size and time resolution together determine the recording duration. The minimum recording duration is 128 ms, and the maximum duration is 51.2 s.

Note that in general:

Recording duration = Time resolution • Size of memory [us]

See also the functional description: "Oscilloscope Feature".

P-0-0032 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	2 / 512		
Default value:	512	**Cyc. transmittable:**	no

P-0-0033, Number of samples after trigger

Parameter P-0-0033 defines the number of probe values, or samples, that will be entered in the probe value list after the trigger event. In this way it is possible to set a parameter to define a trigger delay. Parameter P-0-0033 is used for this.

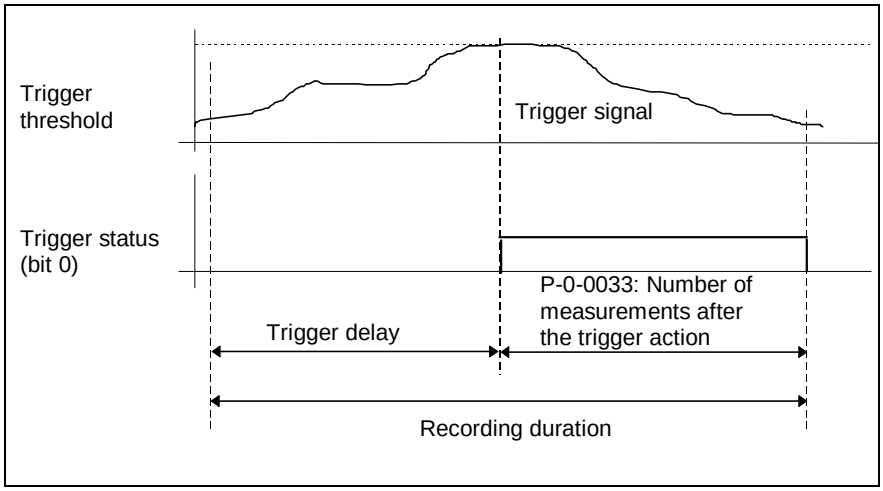


Fig. 3-11: Triggering

See also the functional description: "Oscilloscope Feature".

P-0-0033 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 512		
Default value:	0	**Cyc. transmittable:**	no

P-0-0035, Delay from trigger to start

Parameter P-0-0035 indicates the number of cycles between the trigger event (internal) and the release of the trigger (bit 0 trigger control word) in external triggering.

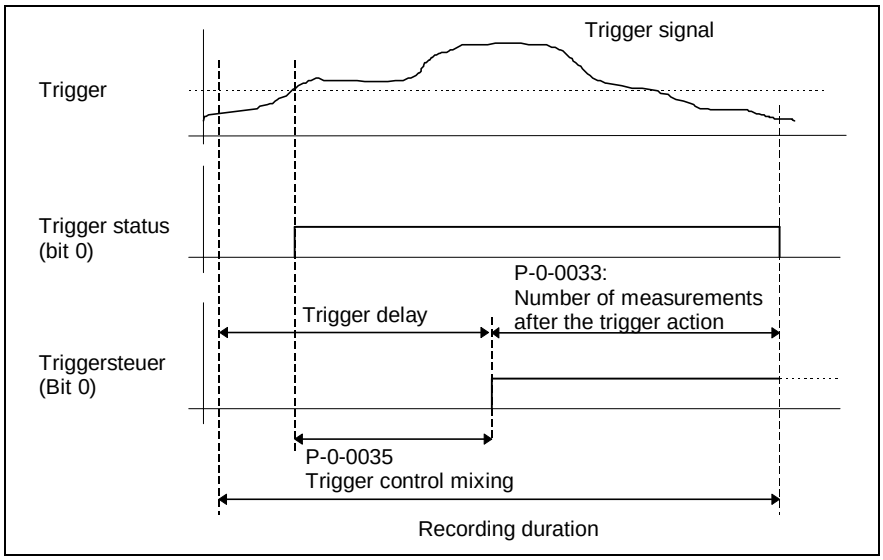


Fig. 3-12: Triggering

Since there is a delay between the transmission of the trigger event by the control system and the release of the trigger, the delay is measured by the drive controller and stored in parameter **P-0-0035, Delay from trigger to start**. A time-correct display of signals is ensured by using this parameter for visualizing the probe values.

See also the functional description: "Oscilloscope Feature".

P-0-0035 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0036, Trigger control word

Parameter P-0-0036 controls the oscilloscope function.

- Bit 2 activates the function, i.e., the lists of scope data are filled with the selected data.
- Bit 1 activates trigger monitoring.
- Bit 0 can initiate a trigger event. If a valid edge is recognized, the probe-value memory will be completed as specified by parameter **P-0-0033, Number of samples after the trigger**, and the oscilloscope function will be deactivated by resetting bits 1 and 2 in the trigger control word.

Parameter structure:

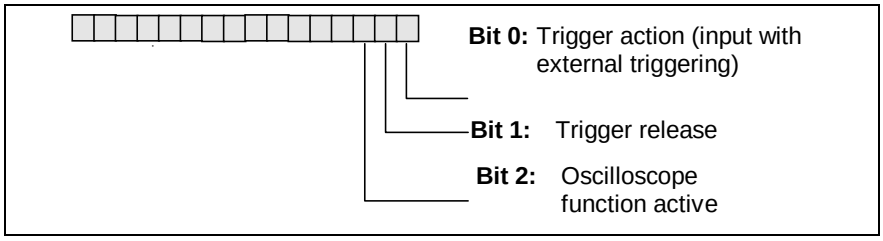


Fig. 3-13: P-0-0036, Trigger control word

See also the functional description: "Oscilloscope Feature".

P-0-0036 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0037, Trigger status word

Status messages for the oscilloscope function.

The parameter P-0-0037 offers various pieces of information about the current status of the oscilloscope function.

Parameter structure:

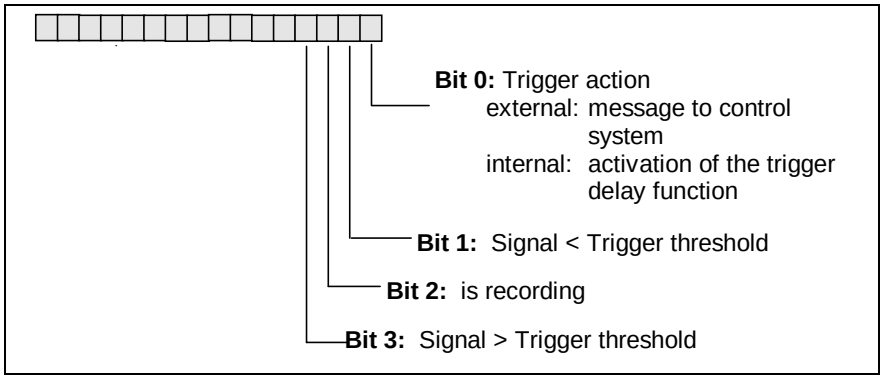


Fig. 3-14: P-0-0037, Trigger status word

See also the functional description: "Oscilloscope Feature".

P-0-0037 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0051, Torque/force constant

The torque/force constant determines what drive torque or force the motor will deliver at a specific effective current.

For **synchronous motors**, this value depends entirely on the design of the motor.

In **asynchronous motors**, this value is valid as long as the motor is not operated in the field-weakening range.

For MHD, MKD and MKE motors, this parameter is stored in the **feedback data memory** and cannot be changed.

MA [Nm, N] = (P-0-0051)•(S-0-0111)•(S-0-0080)

where:

MA	=	Drive torque
P-0-0051	=	Torque/force constant, [Nm/A] or [N/A]
S-0-0111	=	Motor current at standstill [A]
S-0-0080	=	Torque/force command [%]

Fig. 3-15: Drive torque

See also the functional description: "Motor Feedback-Data Memory".

P-0-0051 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	Nm/A	**Extrem value check:**	no
Decimal places:	2	**Combination check:**	no
Input min/max:	0.01 / 655.35		
Default value:	0	**Cyc. transmittable:**	no

P-0-0074, Feedback 1 type

This parameter determines the encoder interface to which the motor encoder is connected. The number of the corresponding interface module should be entered in this parameter.

P-0-0074	Interface:	Measurement system:
1	X4	digital servo feedback or resolver
2	X8	Incremental encoder with sine signals from the Heidenhain company, 1V signals
5	X8	Incremental encoder with square-wave signals from the Heidenhain company
8	X8	Encoder with EnDat interface
9	X8	gearwheel encoder with 1Vss signals
10	X4	Resolver without feedback data memory
11	X4+X8	Resolver without feedback data memory + incremental encoder with sine signals
12	X4+X8	Hall-Feedback + Square-wave signals
13	X4	ECI Feedback
14	X4+X8	Hall-Feedback + sine Feedback

Fig. 3-16: Measurement system:

See also the functional description: "Determining the Feedback Interface of the Motor Feedback".

P-0-0074 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / --		
Default value:	1	**Cyc. transmittable:**	no

P-0-0075, Feedback 2 type

This parameter determines the encoder interface to which the optional encoder is connected. The number of the corresponding interface module should be entered in this parameter.

P-0-0075:	Interface:	Measurement system:
1	X4	digital servo feedback or resolver
2	X8	Incremental encoder with sine-wave signals from the Heidenhain company, 1Vpp signals
5	X8	Incremental encoder with square-wave signals from the Heidenhain company
8	X8	Encoder with EnDat interface
9	X8	Gearwheel with 1Vpp signals

Fig. 3-17: Measurement system:

See also the functional description: "Determining the Feedback Interface of the Motor Feedback"

P-0-0075 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 9		
Default value:	0	**Cyc. transmittable:**	no

P-0-0090, Travel limit parameter

Parameter P-0-0090 activates the travel limit switches. In addition, the inputs can be inverted (0V on input Limit+/- ⇨ Travel limit exceeded).

Parameter structure:

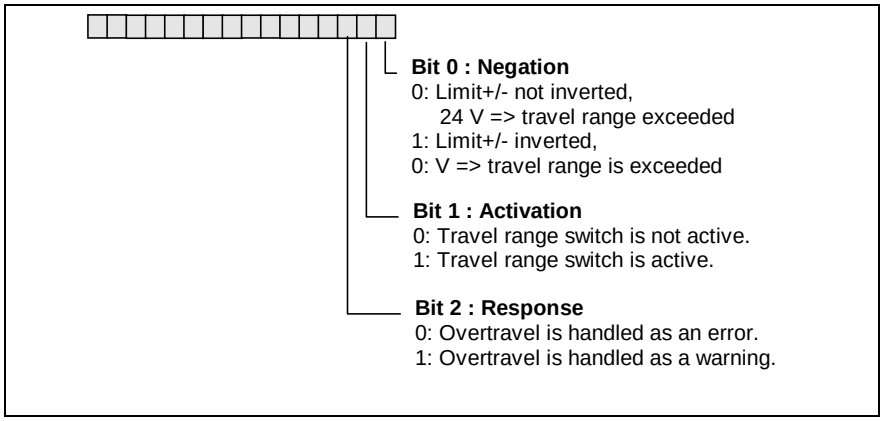

Bit 0 : Negation
0: Limit+/- not inverted,
24 V => travel range exceeded
1: Limit+/- inverted,
0: V => travel range is exceeded
Bit 1 : Activation
0: Travel range switch is not active.
1: Travel range switch is active.
Bit 2 : Response
0: Overtravel is handled as an error.
1: Overtravel is handled as a warning.

Fig. 3-18: P-0-0090, Travel limit parameter

See also the functional description: "Travel range limits".

P-0-0090 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 7		
Default value:	0	**Cyc. transmittable:**	no

P-0-0096, Distance to move in error situation

By inputting a 3 in parameter **P-0-0119, Best possible declaration**, the reaction "return motion“ can be set.

A switch into best possible standstill takes place and the path parametrized here starting with the current feedback position value is traversed (the qualifying sign is noted). The **S-0-0091, Bipolar velocity limit value**, **S-0-0138, Bipolar acceleration limit value** and **S-0-0349, Jerk limit bipolar** hereby not exceeded.

It is necessary to parametrize a sufficiently sized value in **P-0-0126, Maximum braking time** to give the drive enough time to traverse the spezified path.

If the position limit values are active, then the drive keeps the return motion from traversing them. The drive then stops at the **S-0-0057, Position window** at the respective position limit value.

See also the functional description: "Return motion".

P-0-0096 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0097, Absolute encoder monitoring window

The absolute encoder monitoring compares during **S-0-0128, C200 Communication phase 4 transition check** the position saved during the last powering down with the current absolute feedback.

If the difference is greater than what is set in parameter P-0-0097, Absolute encoder monotoring window, the error message **F276 Absolute encoder out of allowed window** will be generated. This can happen, when the axis has been **moved with the power off**, or after changing the motor.

Note: If a 0 is parametrized in P-0-0097, Absolute encoder monitoring window, the absolute encoder monitor is deactivated.

As a standard value, 0.1 motor revolution (= 36 degrees in reference to the motor shaft) can be programmed if the axis has an electrically released brake or a self braking mechanic.

See also the functional description: "Absolute encoder monitoring".

P-0-0097 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	3000	**Cyc. transmittable:**	no

P-0-0098, Max. model deviation

The maximum model deviation is the maximum deviation between the real position feedback value and the model position feedback value calculated by the drive.

This parameter can be read out by the user to help set the parameter for **S-0-0159, Monitoring window**.

Two cases must be distinguished for determining the model position feedback value:

1) Position control with following (lag) error

In this operating mode, the controlled system is simulated by a model.

The maximum deviation between the calculated position feedback module value and the real position feedback value is stored in the parameter P-0-0098.

2) Position control without following (lag) error

In this operating mode, the position command value is compared to the position feedback value. The maximum deviation encountered is stored in P-0-0098.

Note: This parameter can be write accessed so that it can be set back to 0, for example.

See also the functional description: "Position control loop monitoring".

P-0-0098 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	---	**Cyc. transmittable:**	no

P-0-0099, Position command smoothing time constant

The position command smoothing time constant determines the maximum jerk possible in operation modes with closed loop position control.

The maximum jerk is determined by:

$$\text{max. jerk} = \frac{\text{2nd derivative of the position command values}}{\textbf{P-0-0099 Position command value smoothing filter time constant}}$$

Fig. 3-19: Max. jerk

If you don’t want to activate a filter, set P-0-0099 >= S-0-0001, NC Cycle time (TNcyc) (greater or equal).

See also the functional description: "Command value processing : Position Control".

P-0-0099 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 655.35		
Default value:	0	**Cyc. transmittable:**	no

P-0-0109, Torque/force peak limit

The maximum peak torque of a drive can be limited in a manner suitable to an application with the use of parameter P-0-0109, Torque/ force peak limit. In other words, the parameter ensures that the max. torque specific to the application is not exceeded even if **S-0-0092, Bipolar torque/force limit value** is set exceedingly high.

See function description: "Torque/Force Limiting“.

P-0-0109 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0086	**Extrem value check:**	yes
Decimal places:	S-0-0086	**Combination check:**	no
Input min/max:	0 / S-0-0086		
Default value:	5000	**Cyc. transmittable:**	no

P-0-0117, NC reaction on error

This parameter allows the NC 30 seconds to bring the drive controller to a coordinated deceleration in an error situation if the parameter is set with a "1“. The drive follows the command for this period. The drive reacts with the preset **P-0-0119, Best possible deceleration**.

This feature works for non-fatal errors.

Parameter structure:

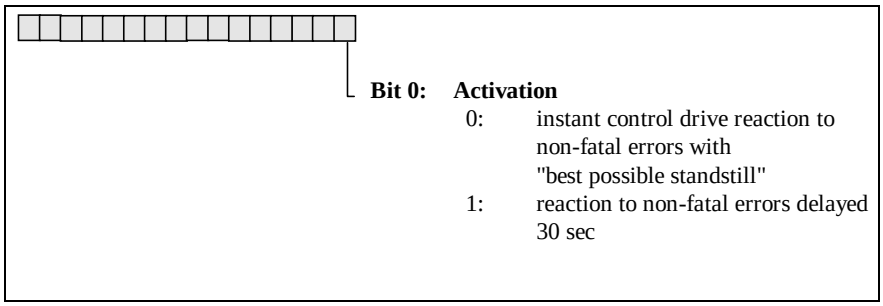

Bit 0: Activation
0: instant control drive reaction to non-fatal errors with "best possible standstill"
1: reaction to non-fatal errors delayed 30 sec

Fig. 3-20: P-0-0117, NC reaction on error

See also the functional description: "NC response in error situation"

P-0-0117 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1		
Default value:	0	**Cyc. transmittable:**	no

P-0-0118, Power off on error

How a drive error is signalled to the drive pack or to the supply module, can be activated in the parameter P-0-0118, Power off on error.

Moreover, there are following possibilities to set the reaction upon error:

- Power off / packet reaction in case of error (bit 0)
- Condition for power up (bit 1)
- Time for switching the power off (bit 2)
- Reaction upon undervoltage (bit 3)
- Undervoltage as fatal warning (bit 4)
- Automatic clearance of undervoltage (bit 5)

Parameter structure:

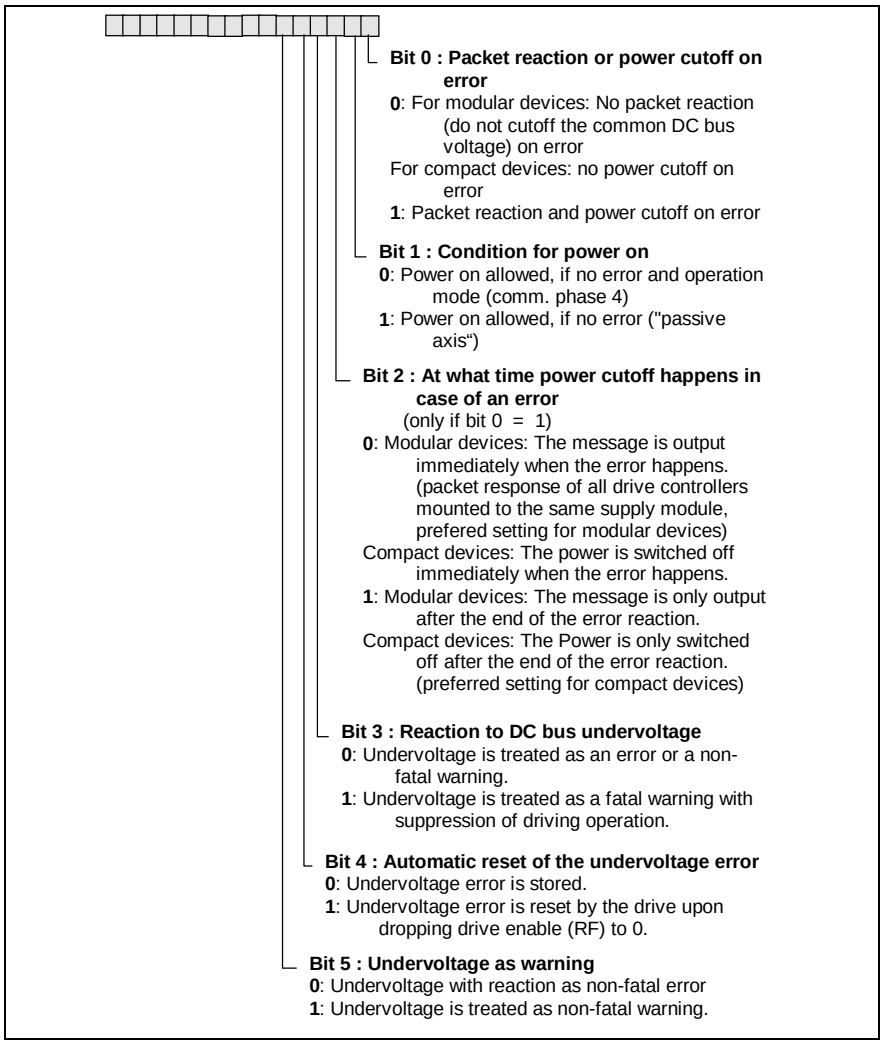

Bit 0 : Packet reaction or power cutoff on error
0: For modular devices: No packet reaction (do not cutoff the common DC bus voltage) on error
For compact devices: no power cutoff on error
1: Packet reaction and power cutoff on error
Bit 1 : Condition for power on
0: Power on allowed, if no error and operation mode (comm. phase 4)
1: Power on allowed, if no error ("passive axis")
Bit 2 : At what time power cutoff happens in case of an error
(only if bit 0 = 1)
0: Modular devices: The message is output immediately when the error happens. (packet response of all drive controllers mounted to the same supply module, prefered setting for modular devices)
Compact devices: The power is switched off immediately when the error happens.
1: Modular devices: The message is only output after the end of the error reaction.
Compact devices: The Power is only switched off after the end of the error reaction. (preferred setting for compact devices)
Bit 3 : Reaction to DC bus undervoltage
0: Undervoltage is treated as an error or a non-fatal warning.
1: Undervoltage is treated as a fatal warning with suppression of driving operation.
Bit 4 : Automatic reset of the undervoltage error
0: Undervoltage error is stored.
1: Undervoltage error is reset by the drive upon dropping drive enable (RF) to 0.
Bit 5 : Undervoltage as warning
0: Undervoltage with reaction as non-fatal error
1: Undervoltage is treated as non-fatal warning.

Fig. 3-21: P-0-0118, Power off on error

See also the functional description: "Power off on error".

P-0-0118 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	--	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 31		
Default value:	10001b	**Cyc. transmittable:**	no

P-0-0119, Best possible deceleration

This parameter specifies the type of braking to standstill for the drive in the event of

- a non-fatal error
- an interface error
- a phase regression
- switching off the drive enable signal

P-0-0119:	Reaction type:
0	**Velocity command value set to zero** The motor brakes in regard to the torque limit value. The **Braking time** is set in parameter **P-0-0126**. 100 milliseconds before the brake time elapses, the blocking brake is activated. If the velocity has previously fallen below 10 rpm (rotational motors) or below 10 mm/min (linear motors), then the blocking brake will be engaged immediately. 100 milliseconds after the mechanical brake is set, the motor is torque free.
1	**Switch to torque-free state**
2	**Velocity command to zero** with command ramp and filter. The ramp, i.e. the maximum acceleration, is set via **P-0-1201, Ramp 1 pitch**, the jerk filter via **P-0-1222, Velocity command filter**.
3	**Return motion** The drive generates a position command profile for traversing the set "path on error“ in which case a relative path is activated which is defined with **P-0-0096, Distance to move in error situation**, **S-0-0091, Bipolar Velocity Limit Value**, **S-0-0138, Bipolar acceleration limit value** and **S-0-0349, Jerk Limit bipolar**.

Fig. 3-22: Deceleration mode for the drive

The drive enable can be set again, at the earliest, after the operation of the error reaction.

See also the functional description: "Best Possible Deceleration".

P-0-0119 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 3		
Default value:	0	**Cyc. transmittable:**	no

P-0-0121, Velocity mix factor feedback 1 & 2

The Velocity mix factor parameter determines the relation of the velocity feedback values between the motor encoder and the optional encoder.

The input is percentage-based. Note the following:

0 % : The velocity controller works solely with the velocity of the motor encoder (= encoder 1).

100 % : The velocity controller works solely with the velocity of the opt. encoder (= encoder 2).

If no optional encoder is available, then the parameter is set to 0 % .

See also the functional description: "Setting the velocity mix factor".

P-0-0121 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	%	**Extrem value check:**	no
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 100.0		
Default value:	0	**Cyc. transmittable:**	no

P-0-0123, Absolute encoder buffer

All the data that the absolute encoder needs for position initialization is stored in this parameter.

See also the functional description: "Other Settings for Absolute Measurement Systems".

P-0-0123 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0126, Maximum braking time

The maximum braking time for the drive is set in this parameter.

The value should always be set higher then the time needed, considering the maximum possible velocity, to decelerate the shaft using velocity command value zero-switching.

The velocity command value is switched to zero if **P-0-0119, Best possible deceleration** is set to 0 and either

- The drive enable (RF) is removed
- The drive is switched to Set parameter mode with RF switched on
- A drive error is recognized that still allows a reaction from the drive (all non-fatal errors)
- In the case of separately supplied devices (HDS), a drive connected to the same supply module reports an error to that module, so that the intermediate voltage is switched off.

P-0-0126 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	500 / 100000		
Default value:	5000	**Cyc. transmittable:**	no

P-0-0127, Overload warning

To protect the power stage, the temperature is calculated with a temperature model for the transistor final stage. If the temperature exceeds 125°C, then the torque-producing command current will be limited.

To avoid an unexpected disruption of the torque from the drive, a warning threshold can be set in this parameter.

If the thermal load rises above the set value, warning **E261 Continuous current limiting prewarning** will be generated.

If 100% is entered, this warning will be deactivated, because then the message **E257 Continuous current limit active** will be generated instead.

See also the functional description: "Monitoring the Thermal Load of the drive controller".

P-0-0127 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	%	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	00000 / 100		
Default value:	8090	**Cyc. transmittable:**	no

P-0-0131, Signal select position switch

This parameter can be used to activate and to select the signal for the programmable position switch.

The following values can be entered:

P-0-0131:	Function:
0	The programable limit switch is not activated.
1	The programable limit switch is activated; the reference signal is **S-0-0051, Position feedback value 1**
2	The programable limit switch is activated; the reference signal is **S-0-0053, Position feedback value 2**

Fig 3-1: Activation and signal selection for the programmable position switch

See also the functional description: "Programmable Limit Switch".

P-0-0131 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 2		
Default value:	1	**Cyc. transmittable:**	-

P-0-0132, Switch on threshold position switch

This parameter list can be used to set the switch-on positions for the programmable limit switch.

It consists of **16 elements**, where element 1 is allocated for the position switch bit 1, element 2 is allocated for bit 2, and so forth.

See also the functional description: "Programmable Limit Switch"

P-0-0132 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Param.-E²prom
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	-	**Cyc. transmittable:**	no

P-0-0133, Switch off threshold position switch

This parameter list can be used to set the switch-off positions for the programmable limit switch.

It consists of **16 elements**, where element 1 is allocated for the position switch bit 1, element 2 is allocated for bit 2, and so forth.

See also the functional description: "Programmable Limit Switch".

P-0-0133 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Param.-E²prom
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	-	**Cyc. transmittable:**	no

P-0-0134, Position switch lead times

By parameterizing a rate time, a time delay can be compensated for an external, position-driven switch element. In that way, a theoretical adjustment value can be calculated from the rate time and the current drive velocity for the on- and off-switch Positions.

The programmable limit switch switches by the rate time before reaching the trigger position.

Note: The velocity must remain constant in the range between the theoretical and actual on-switch or off-switch threshold.

See also the functional description: "Programmable Limit Switch"

P-0-0134 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / 32767		
Default value:	-	**Cyc. transmittable:**	-

P-0-0135, Status position switch

The state of the programmable limit switch bits is displayed in this parameter.

Parameter structure with 16 switches:

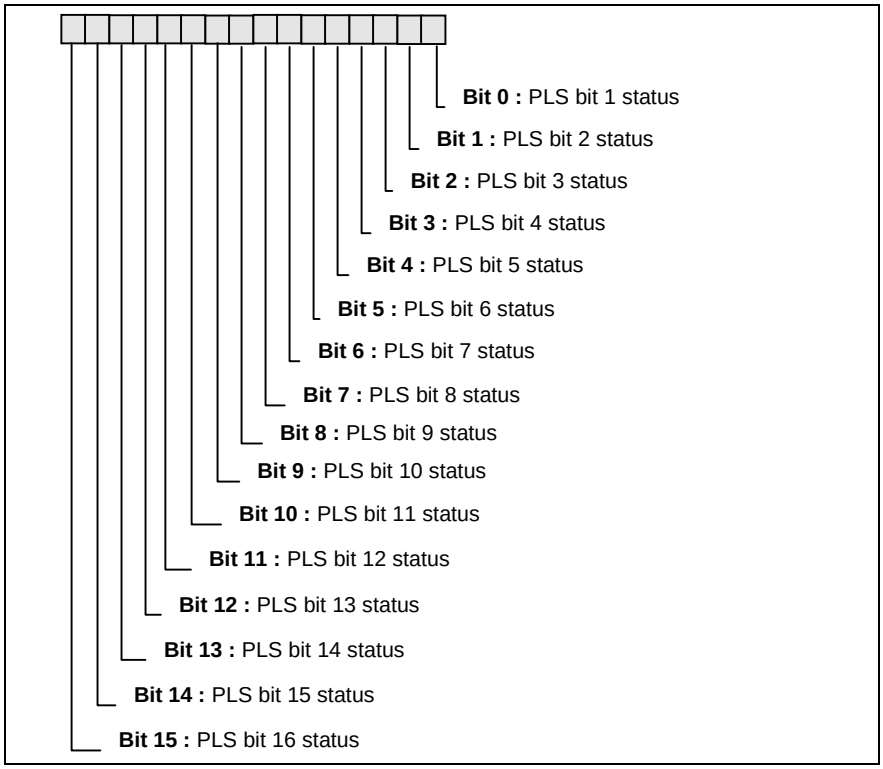

Bit 0 : PLS bit 1 status
Bit 1 : PLS bit 2 status
Bit 2 : PLS bit 3 status
Bit 3 : PLS bit 4 status
Bit 4 : PLS bit 5 status
Bit 5 : PLS bit 6 status
Bit 6 : PLS bit 7 status
Bit 7 : PLS bit 8 status
Bit 8 : PLS bit 9 status
Bit 9 : PLS bit 10 status
Bit 10 : PLS bit 11 status
Bit 11 : PLS bit 12 status
Bit 12 : PLS bit 13 status
Bit 13 : PLS bit 14 status
Bit 14 : PLS bit 15 status
Bit 15 : PLS bit 16 status

Fig. 3-23: P-0-0135, Position switches' status word

See also the functional description: "Programmable Limit Switch".

P-0-0135 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-0139, Analog output 1

The parameter **P-0-0139, Analog output 1** sets the voltage value for the analog output 1 of the drive controller.

See also the functional description: "Analog Output".

P-0-0139 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	V	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	-10000 / 10000		
Default value:	---	**Cyc. transmittable:**	MDT

P-0-0140, Analog output 2

The parameter **P-0-0140, Analog output 2** sets the voltage value for the analog output 2 of the drive controller.

See also the functional description: "Analog Output".

P-0-0140 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	V	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	-10000 / 10000		
Default value:	---	**Cyc. transmittable:**	MDT

P-0-0141, Thermal drive load

The parameter P-0-0141, Thermal drive load is for diagnostic purposes. In this parameter, 0% corresponds to a chip over-temperature of 0 Kelvin, 100% corresponds to the maximum chip over-temperature. The thermal load should not exceed a value of 80% for the applied operating cycles if the drive is set up correctly.

It typically takes about 10 minutes to warm up a drive controller end stage to its final temperature. To check the thermal load of a drive during installation without having to run operating cycles during this period of time, the drive controller load can be preset with 80%.

This can happen by writing an arbitrary value to the parameter **P-0-0141, Thermal drive load**.

See also the functional description: "Checking the Thermal Load of the drive controller".

P-0-0141 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	%	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	00000 / 100		
Default value:	---	**Cyc. transmittable:**	no

P-0-0145, Expanded trigger level

This parameter is for service purposes only.

If bit 12, Expanded trigger level is selected using parameter **P-0-0026, Trigger signal selection**, then an address can be selected with parameter P-0-0145 that is monitored for the threshold parameter value.

Parameter structure:

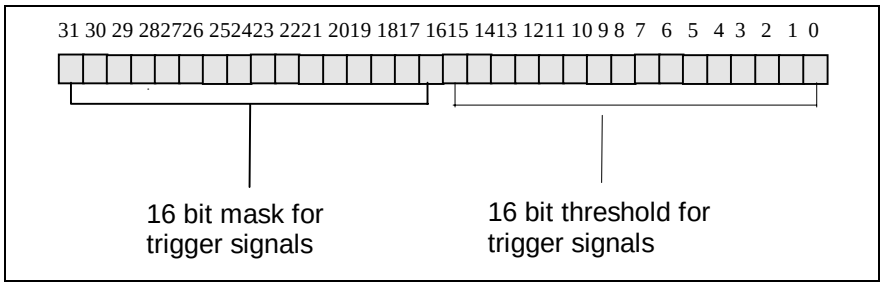


Fig. 3-24: P-0-0145, Expanded trigger level (oscilloscope function)

See also the functional description: "Oscilloscope feature".

P-0-0145 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0146, Expanded trigger address

This parameter is for service purposes only.

If bit 12 Expanded trigger level is selected in using parameter **P-0-0026, Trigger signal selection**, then an address can be selected with parameter P-0-0146 that is monitored for the threshold parameter value.

Parameter structure:

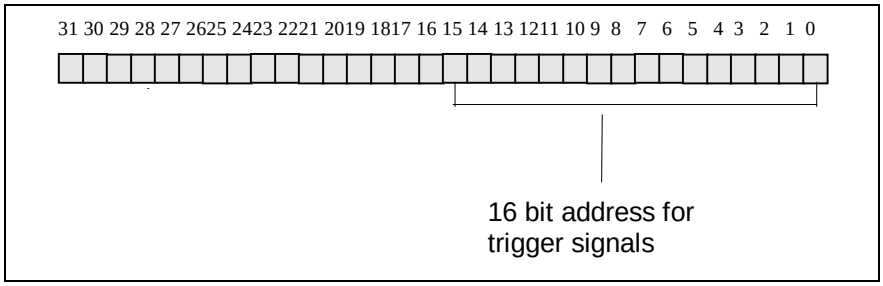


Fig. 3-25: P-0-0146, Expanded trigger address

The 16-bit value of the trigger edge is monitored. Before, the trigger signal is ANDed with the mask for trigger signals.

See also the functional description: "Oscilloscope feature".

P-0-0146 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0147, Expanded signal K1 address

If an expanded signal selection is made with parameters **P-0-0023, Signal select scope channel 1** and **P-0-0024, Signal select scope channel 2**, then an address to be recorded can be chosen in the drive with parameter P-0-0147.

See also the functional description: "Oscilloscope feature".

P-0-0147 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0148, Expanded signal K2 address

If an expanded signal selection is chosen with parameters **P-0-0023, Signal select scope channel 1** and **P-0-0024, Signal select scope channel 2**, then an address to be recorded can be chosen in the drive with parameter P-0-0148.

See also the functional description: "Oscilloscope feature".

P-0-0148 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0149, List of selectable signals for oscilloscope function

The control system can read drive-supported, predefined signals with parameter P-0-0149. This permits a user interface to prepare a signal select menu using the information in the listed parameters in the drive.

List entries:	ID number of:
1	S-0-0051 or S-0-0053
2	S-0-0040
3	S-0-0347
4	S-0-0189
5	S-0-0080
6	S-0-0051
7	S-0-0053
8	S-0-0047
9	P-0-0147
10	P-0-0148

Fig. 3-26: P-0-0149, List of selectable signals for oscilloscope function

See also the functional description: "Oscilloscope feature".

P-0-0149 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0150, Number of valid samples for oscilloscope function

If the oscilloscope function is activated then the signal to be recorded is continously fed to a value memory. If triggering occurs, then the recording procedure is stored and the value list can be read out. The oldest measured value is the first element of this list, the newest value the last.

If triggering occurs before the memory is completely filled, then a number of values at the start of the list are invalid.The number of valid values before triggering is available in parameter **P-0-0150, Number of valid samples for oscilloscope function**.

See also the functional description: "Oscilloscope feature".

P-0-0150 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0153, Optimal distance home switch - reference mark

During command "**Drive-controlled homing**" when the zero-switch and homing mark evaluation are activated, the distance between the zero-switch edge and the homing mark is monitored. For reference marks (home reference) with equal intervals, the optimal distance is half the home-reference interval. The optimal distance can be entered in parameter P-0-0153, Optimal distance home switch - reference mark as per the following table:

Encoder type	P-0-0153	Function
Rotational	0	The zero-switch - reference mark interval is monitored. The optimal distance will be calculated internally, and is equal to 1/2 of an encoder revolution for DSF or incr. rotary encoders, or 1/2 of an encoder revolution / **S-0-0116, Rotary encoder resolution - 1** for resolvers.
Rotational	x	The zero-switch - reference mark interval is monitored. Half the reference mark distance must be entered in **P-0-0153, Optimal distance home switch - reference mark**.
Linear	0	The zero-switch - reference mark interval is not monitored. The linear encoder does not affect reference marks with constant intervals. The real distance between the zero-switch and the reference mark must be large enough to ensure recognition of the zero-switch edge, taking into account the maximum homing velocity and the cycle time for the zero-switch input request.
Linear	x	The zero-switch - reference mark interval is monitored. Half the reference mark distance must be entered in **P-0-0153, Optimal distance home switch - reference mark**.

Fig. 3-27: Interval monitoring, home switch - reference mark

See also the functional description: "Drive-controlled homing".

P-0-0153 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	S-0-0076	**Validity check:**	Phase3
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0162, D900 Command Automatic control loop adjust

Starting this command executes an automatic control loop setting in the drive as soon as the drive is in the loop with command start.



WARNING

⇒ This can effect an immediate motion if **drive enable** and **drive start** are applied to the drive.

⇒ The drive now conducts autonomous motions within the travel range defined by both limits.

All pre-settings affecting the command, such as **P-0-0163, damping factor for automatic control loop settings, P-0-0164, application for autom. control loop setting, S-0-0092, bipolar torque/force limit value** and **S-0-0259, positioning speed** must also first be set.

Note: **Errors** can occur during the execution of a command. These are signalled with messages.

D901 Start requires drive enable

D902 Motor feedback data not valid

D903 Inertia detection failed

D904 Gain adjustment failed

D905 Travel range invalid, P-0-0166 & P-0-0167

D906 Travel range exceeded

See also the functional description: "Automatic control loop settings".

P-0-0162 - Attributes

Function:	Command	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-0163, Damping factor for autom. control loop adjust

By varying P-0-0163, the user has the option to influence control loop dynamics set by the automatic control loop setting.

Note: **P-0-0163 = 20** **⇒ least dynamic**

P-0-0163 = 0.5 **⇒ max. dynamic**

See also the functional description: "Automatic control loop settings".

P-0-0163 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	-
Unit:	--	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0.5 / 20		
Default value:	2.5	**Cyc. transmittable:**	no

P-0-0164, Application for autom. control loop adjust

In order to take control strategies related to an application into consideration with the automatic control loop settings, the user receives a **selection list** from which the desired application can be selected.

This offers, e.g., the option to completely switch the I-gain off, for example.

The information below relates to the velocity loop.

P-0-0164	Application	I-gain	P-gain
0	tool machine ⇨ good load rigidity	with	normal
1	nipple machine ⇨ short settling times	without, Tn = 0ms	high
2	simultaneously running separation device ⇨ rel. undynam. control loop setting	without, Tn = 0ms	normal
3	Drum feeder ⇨ very high load inertia	with	high
4	Handling axis ⇨ possible oscillation	with	small

Fig. 3-28: Application-dependent velocity loop setting

Note: Indramat will expand this table according to the needs.

The **default value** is set for a **machine tool**.

See also the functional description: "Automatic Control Loop Settings".

P-0-0164 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEV_OV	**Validity check:**	nicht
Unit:		**Extrem value check:**	-
Decimal places:	0	**Combination check:**	-
Input min/max:	0 / 3		
Default value:	0	**Cyc. transmittable:**	no

P-0-0165, Selection for autom. control loop adjust

By selecting the corresponding bit, you can **select** (bit = 1) or **deselect** (bit = 0) any partial functionality of the automatic control loop setting.

The following table describes the possibilities for selection.

Parameter structure:

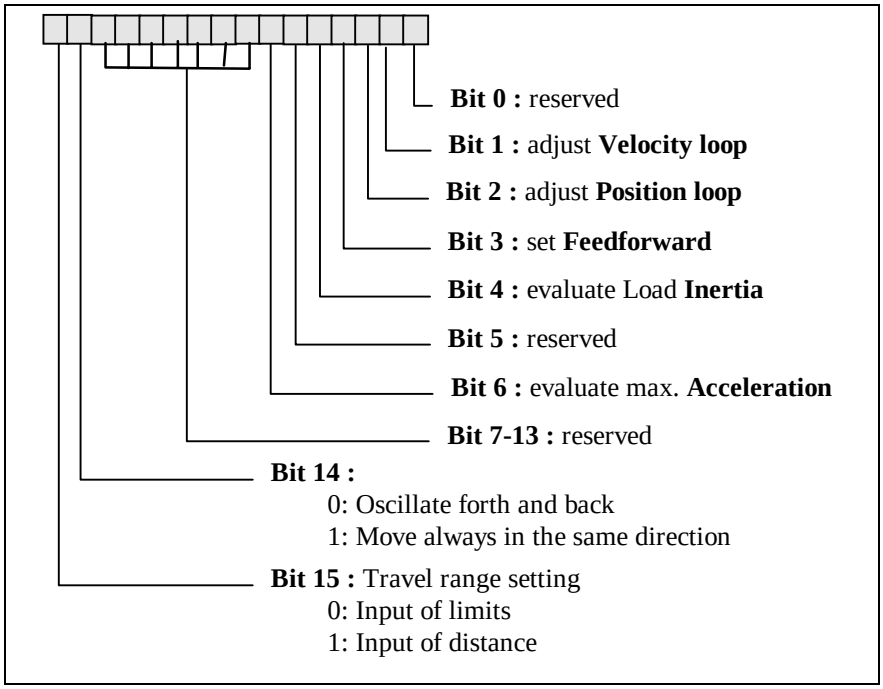

Bit 0 : reserved
Bit 1 : adjust Velocity loop
Bit 2 : adjust Position loop
Bit 3 : set Feedforward
Bit 4 : evaluate Load Inertia
Bit 5 : reserved
Bit 6 : evaluate max. Acceleration
Bit 7-13 : reserved
Bit 14 :
0: Oscillate forth and back
1: Move always in the same direction
Bit 15 : Travel range setting
0: Input of limits
1: Input of distance

Fig. 3-29: Selection parameter for autom. control loop setting

Example:

The default setting (P-0-0165 = 0000 0000 0001 0110) means:

- Load inertia is evaluated.
- Velocity loop is adjusted.
- Position loop is adjusted.

See also the functional description: "Automatic control loop settings".

P-0-0165 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	BIN	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	yes
Input min/max:	0 / 0xFFFF		
Default value:	0x0016	**Cyc. transmittable:**	no

P-0-0166, Lower position limit for autom. control loop adjust

The allowed range, within which the axis may move during the automatic control loop adjust with the command P-0-0162, is defined by

- a lower position limit **P-0-0166** and
- an upper position limit **P-0-0167**.

These two limits can either be

- input directly
- or they are calculated internally, based on a defined travel distance P-0-0169, taking into account the actual position at the start of the command D9 (P-0-0165, bit 12 = 1).

Note: At the start of the command D9, a check is run of the travel range defined by both parameters P-0-0166 and P-0-0167.

See also the functional description: "Automatic control loop settings".

See also **D905 wrong position range**

See also **D906 position range exceeded**

P-0-0166 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0167, Upper position limit for autom. control loop adjust

The allowed range, within which the axis may move during the automatic control loop adjust with the command P-0-0162, is defined by

- a lower position limit **P-0-0166** and
- an upper position limit **P-0-0167**.

These two limits can either be

- input directly
- or they are calculated internally, based on a defined travel distance P-0-0169, taking into account the actual position at the start of the command D9 (P-0-0165, bit 12 = 1).

Note: At the start of the command D9, a check is run of the travel range defined by both parameters P-0-0166 and P-0-0167.

See also the functional description: "Automatic control loop settings".

See also **D905 wrong position range**

See also **D906 position range exceeded**

P-0-0167 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0168, Maximum acceleration

This parameter holds the maximum possible acceleration found during the automatic control loop setting, if the function is selected in the P-0-0165, Selection for autom. control loop adjust (P-0-0165, Bit 6 = 1).

The value is, in a first approximation, inversely proportional to the total inertia (motor + load) of the drive and directly proportional to the peak torque or force of the drive.

Note: P-0-0168 serves as **initial value** for a later setting of **the positioning block accelerations**.

See also the functional description: "Automatic Control Loop Setting".

P-0-0168 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0160	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	0	**Cyc. transmittable:**	no

P-0-0169, Travel distance for autom. control loop adjust

The allowed range, within which the axis may move during the automatic control loop adjust with the command P-0-0162, is defined by

- a lower position limit **P-0-0166** and
- an upper position limit **P-0-0167**.

These two limits can either be

- input directly (P-0-0165, Bit12 = 0)
- or they are calculated internally, based on a defined travel distance P-0-0169, taking into account the actual position at the start of the command D9 (P-0-0165, bit 12 = 1).
- P-0-0166 = Start position - P-0-0169 / 2
- P-0-0167 = Start position + P-0-0169 / 2

Note:

At the start of the command D9, a check is run of the travel range defined by both parameters P-0-0166 and P-0-0167.

P-0-0169 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / S-0-0076		
Default value:	0	**Cyc. transmittable:**	no

P-0-0176, Torque/Force command smoothing time constant

The parameter P-0-0176, Torque/force command smoothing time constant is only active during the operation mode Torque control.

The time constant input here filters during torque control the command value given by S-0-0080, Torque/Force command via a low pass filter. This can smoothen acceleration jumps in successive command values.

See also the functional description: "Operating Mode: Torque Control".

P-0-0176 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1000		
Default value:	0	**Cyc. transmittable:**	no

P-0-0180, Rejection frequency velocity loop

To supress the mechanical resonance frequency, a band filter can be activated at the output of the velocity controller .It is parametrized with parameters **P-0-0180, Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop**.

P-0-0180, Rejection frequency velocity loop indicates the most attenuated frequency.

See also the functional description: "Filtering oscillations from mechanical resonance".

P-0-0180 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Hz	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	50 / 950		
Default value:	900	**Cyc. transmittable:**	no

P-0-0181, Rejection bandwidth velocity loop

To supress the mechanical resonance frequency, a band filter can be activated at the output of the velocity controller. It is parametrized with parameters **P-0-0180, Rejection frequency velocity loop** and **P-0-0181, Rejection bandwidth velocity loop**.

P-0-0181, Rejection bandwidth velocity loop sets the frequency range for the locking frequency with an attenuation smaller than -3dB.

Example:

P-0-0180 = 500 Hz,

P-0-0181 = 200 Hz;

then: attenuation < -3dB in range of 400..600 Hz.

Parameter content	Effect of P-0-0181
-1	low pass filter with time constant P-0-0004
0	filter is off
>0	bandwidth of suppression (notch) filter

Fig. 3-30: P-0-0181, Rejection bandwidth velocity loop

See also the functional description: "Filtering oscillations from mechanical resonance".

P-0-0181 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Hz	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	-1 / 500		
Default value:	0	**Cyc. transmittable:**	no

P-0-0185, Function of encoder 2

Parameter P-0-0185 can be used to allocate a specific function to an optional encoder. The following functions are defined:

Value in P-0-0185, Function of encoder 2	Meaning
0	Optional encoder as additional loadside control feedback for position and/or velocity loop. The signal frequency is monitored whether it exceeds the max. possible frequency for the interface. In case of excess, the error **F246 Max. signal frequency for encoder 2 exceeded** is generated, and the position status S-0-0403 is cleared.
2	Optional encoder as singular loadside control feedback (only with rotary asynchronous motor). In this case, there is no motor encoder (P-0-0074 = 0). The parameter **P-0-0121, Velocity mix factor encoder 1 & 2** must be set to 100 % .
3	optional encoder with measuring wheel encoder

Fig. 3-31: Function of optional encoder

Explanation:

- If the optional encoder is used as a **control encoder**, it can be used to close the control loop. All modes are possible with ext. enc. The position value is set in **S-0-0053, Position feedback value 2 (opt. feedback)**
- If the optional encoder is used as a **motor encoder**, the control loop and commutation are generated from this encoder. Only **S-0-0053, Position feedback value 2 (opt. feedback)** is supported.

See also the functional description: "optional encoder".

P-0-0185 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0190, Operating hours control section

The operating hours of the control section are displayed here. With this parameter, the entire on time of control electronics since installation of the unit can be displayed. If a class 1 error occurs, the contents of this parameter at that time is first stored in **P-0-0193, Error recorder, operating hours control section**.

See also the functional description: "Error memory and operating hour counter".

P-0-0190 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	h	**Extrem value check:**	no
Decimal places:	4	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0191, Operating hours power section

With this parameter, the entire on time of control electronics since installation of the unit can be displayed. This is the time over which the drive was operated with drive enable on.

See also the functional description: "Error memory and operating hour counter".

P-0-0191 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	h	**Extrem value check:**	no
Decimal places:	4	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0192, Error recorder, diagnosis number

If the drive reports a class 1 error (C1D), a bit is set in **S-0-0011, Class 1 diagnostics** C1D. In the drive status word Bit 13 for "Error C1D“ is set.

Additionally, for a precise diagnosis,

- the diagnosis number is shown in the 7- segment display and stored in **S-0-0390, Diagnostic message number**,
- the plain text diagnosis is stored in **S-0-0095, Diagnostic message**,

- and the relevant error number in **P-0-0009, Error message number**.

When the error is cleared, then the diagnosis number of the error displayed **in S-0-0390, Diagnostic message number** is stored in **P-0-0192, Error recorder diagnosis number**. This parameter shows the diagnosis numbers of the last 19 errors in chronological order in the form of a stack memory. The last cleared error is on top.

The status of **P-0-0190, Operating hours control section** at the time the error was deleted is stored in **P-0-0193, Error recorder, operating hours control section**.

See also the functional description: "Error memory and operating hour counter".

P-0-0192 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	Verst. EE
Format:	HEX	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0193, Error recorder, operating hours control section

If the drive reports a class 1 error (C1D), then a bit is set in **S-0-0011, Class 1 diagnostics** C1D. Bit 13 for "Error C1D“ is set in the drive status word.

Additionally, for a precise diagnosis,

- the diagnosis number is shown in the 7-segment display and stored in **S-0-0390, Diagnostic message number**,
- the clear text diagnosis is stored in **S-0-0095, Diagnostic message**,
- and the relevant error number in **P-0-0009, Error message number**.

When the error is reset, then the status of **P-0-0190, Operating hours control section** at the time the error was detected is stored in **P-0-0193, Error recorder, operating hours control section**. This parameter shows the diagnosis numbers of the last 19 errors in chronological order. On the topmost position, there is the counter value of the last occured error.

The status of **P-0-0192, Error recorder diagnosis number** at the time the error was deleted in the order in **S-0-0390, Diagnostic message number**.

See also the functional description: "Error memory and operating hour counter".

P-0-0193 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte var.	**Memory:**	Verst. EE
Format:	HEX	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0200, Signal select probe 1

This parameter is used to select what measured quantity will be used for probe input 1.

The following signals can be selected:

P-0-0200:	Selected signal:
0	Position feedback value 1 or 2, dependent on **S-0-0169, Probe control parameter** bit 4
1	Time measurement in µs

Fig. 3-32: P-0-0200, Signal select probe 1

See also the functional description: "Probe Input Feature".

P-0-0200 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 4		
Default value:	0	**Cyc. transmittable:**	no

P-0-0201, Signal select probe 2

This parameter is used to select what measured quantity will be used for probe input 2.

The following signals can be selected:

P-0-0201:	Selected signal:
0	Position feedback value 1 or 2, dependent on **S-0-0169, Probe control parameter** bit 4
1	Time measurement in µs

Fig. 3-33: P-0-0201, Signal select probe 2

See also the functional description: "Probe Input Feature".

P-0-0201 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 2		
Default value:	0	**Cyc. transmittable:**	no

P-0-0202, Difference probe values 1

The difference between the **S-0-0130, Probe value 1 positive** and the **S-0-0131, Probe value 1 negative** of probe 1 is stored in this parameter. The value is always recalculated when a new positive or negative probe value is latched.

See also the functional description: "Probe Input Feature".

P-0-0202 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0200	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0200	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

P-0-0203, Difference probe values 2

The difference between the **S-0-0130, Probe value 2 positive** and the **S-0-0131, Probe value 2 negative** of probe 2 is stored in this parameter. The value is always recalculated when a new positive or negative probe value is latched.

See also the functional description: "Probe Input Feature".

P-0-0203 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	S-0-0076/P-0-0200	**Extrem value check:**	no
Decimal places:	S-0-0076/P-0-0200	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	AT

P-0-0210, Analog input 1

This parameter displays the analog voltage applied at the analog channel 1 in volts with 3 decimal places.

See also the functional description: "Analog Inputs".

P-0-0210 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	V	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	-- / --		
Default value:	---	**Cyc. transmittable:**	no

P-0-0211, Analog input 2

This parameter displays the analog voltage applied at the analog channel 2 in volts with 3 decimal places.

See also the functional description: "Analog Inputs".

P-0-0211 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	V	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no

Input min/max:	-- / --		
Default value:	---	**Cyc. transmittable:**	no

P-0-0212, Analog inputs, IDN list of assignable parameters

The digitalized values of both analog inputs are stored in **P-0-0210, Analog input 1** and **P-0-0211, Analog input 2**. These can be allocated via settable scaling to other drive parameters or cyclically copied. The allowed parameters for allocation are listed in **P-0-0212, Analog inputs, IDN list of assignable parameters**.

Contents P-0-0212:

- **S-0-0000, Zero-Parameter to switch off**
- **S-0-0036, Velocity command value**
- **S-0-0037, Additive velocity command value**
- **S-0-0047, Position command value**
- **S-0-0080, Torque/Force command**
- **S-0-0091, Bipolar velocity limit value**
- **S-0-0092, Bipolar torque/force limit value**
- **S-0-0108, Feedrate override**

See also the functional description: "Analog Inputs".

P-0-0212 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	--
Decimal places:	--	**Combination check:**	--
Input min/max:	-- / --		
Default value:	---	**Cyc. transmittable:**	no

P-0-0213, Analog input 1, assignment

The digitalized values of both analog inputs are stored in **P-0-0210, Analog input 1** and **P-0-0211, Analog input 2**. These can be allocated via settable scaling to other drive parameters or cyclically copied.

To copy cyclically the analog input 1 to a drive parameter, the ID no. of this parameter must be entered.

If the ID no. Entered in **P-0-0213, Analog input 1, assignment** not in **P-0-0212, Analog inputs, IDN list of assignable parameters**, then the service channel error message "data not correct“ is generated.

Note: If the allocation is to be deleted, enter the ID no. S-0-0000.

See also the functional description: "Analog Inputs".

P-0-0213 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0214, Analog input 1, scaling per 10V full scale

The digitalized values of both analog inputs module are stored in the parameters **P-0-0210, Analog input 1** and **P-0-0211, Analog input 2**. These can be assigned to other drive parameters via settable scalings, i.e., copied.

If analog input 1 is cyclically copied to a drive parameter, i.e., an ID no. Has been entered in **P-0-0213, Analog input 1, assignment**, then avalue of 10V of the analog voltage in terms of the assigned parameter is entered.

The unit and the number of decimal places of **P-0-0214, Analog input 1, scaling per 10V full scale** correspond to those of **P-0-0213, Analog input 1, assignment**.When inputting **P-0-0213, Analog input 1, assignment**, both unit and decimal places of **P-0-0214, Analog input 1, scaling per 10V full scale** are switched appropriately.

See also the functional description: "Analog Inputs".

P-0-0214 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	---	**Validity check:**	no
Unit:	---	**Extrem value check:**	no
Decimal places:	---	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	3000	**Cyc. transmittable:**	no

P-0-0215, Analog input 2, assignment

The digitalized values of both analog inputs are stored in **P-0-0210, Analog input 1** and **P-0-0211, Analog input 2**. These can be allocated via settable scaling to other drive parameters or cyclically copied.

To copy cyclically the analog input 2 to a drive parameter, the ID no. of this parameter must be entered.

If the ID no. Entered in **P-0-0213, Analog input 2, assignment** not in **P-0-0212, Analog inputs, IDN list of assignable parameters**, then the service channel error message "data not correct“ is generated.

Note: If the allocation is to be deleted, enter the ID no. S-0-0000.

See also the functional description: "Analog Inputs".

P-0-0215 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	---	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0216, Analog input 2, scaling per 10V full scale

The digitalized values of both analog inputs are stored in the parameters **P-0-0210, Analog input 1** and **P-0-0211, Analog input 2**. These can be assigned to other drive parameters via settable scalings, i.e., copied.

If analog input 1 is cyclically copied to a drive parameter, i.e., an ID no. Has been entered in **P-0-0215, Analog input 2, assignment**, then avalue of 10V of the analog voltage in terms of the assigned parameter is entered.

The unit and the number of decimal places of **P-0-0216, Analog input 2, scaling per 10V full scale** correspond to those of **P-0-0215, Analog input 2, assignment**. When inputting **P-0-0215, Analog input 2, assignment**, both unit and decimal places of **P-0-0216, Analog input 2, scaling per 10V full scale** are switched appropriately.

See also the functional description: "Analog Inputs".

P-0-0216 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	---	**Validity check:**	no
Unit:	---	**Extrem value check:**	no
Decimal places:	---	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	3000	**Cyc. transmittable:**	no

P-0-0217, Analog input 1, offset

The analog channels can be processed with a DC offset. It has the unit millivolt, and this value is subtracted from the analog value.

See also the functional description: "Analog Inputs".

P-0-0217 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	V	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	-10000 / 10000		
Default value:	0	**Cyc. transmittable:**	no

P-0-0218, Analog input 2, offset

The analog channels can be processed with a DC offset. It has the unit millivolt, and this value is subtracted from the analog value.

See also the functional description: "Analog Inputs".

P-0-0218 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_MV	**Validity check:**	Phase3
Unit:	V	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	-10000 / 10000		
Default value:	0	**Cyc. transmittable:**	no

P-0-0220, D800 Command Measuring wheel operation mode

With this parameter, the command Measuring wheel operation mode is started.

When position control is active, setting this command switches over to position control with feedback 1 and 2. Before, drive sets the position feedback 2 to the same value as the position feedback 1.

If another operation mode is active, the feedback values are taken from feedback 2.

When the command is cleared, the drive sets the position feedback 1 to the same value as the position feedback 2 and switches back again to position control with feedback 1.

Condition for starting the command:

- External feedback present and announced as measuring wheel (P-0-0185 = 3)

If the condition is not met, the command error message „D801 Measuring wheel operation not possible“ is generated.

See also the functional description: Measuring Wheel operation.

P-0-0220 - Attributes

Function:	Command	**Editability:**	P4
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 3		
Default value:	-	**Cyc. transmittable:**	no

P-0-0221, Actual position filter time const. for measuring wheel mode

When the command measuring wheel operation is active, the position loop is closed with the sum of

- the position feedback value 1 and
- the filtered difference between the values of position feedback 2 and position feedback 1.

The time constant of the used filter is determined by this parameter.

The aim of damping the differential position feedback is to smoothen negative effects from a bad coupling between the encoder 2 and the motor shaft (e.g. when the measuring wheel lifts off the material).

The final position is determined by the position feedback value 2 only.

See also the functional description: Measuring wheel operation.

P-0-0221 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	ms	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 32767		
Default value:	1000	**Cyc. transmittable:**	no

P-0-0222, State of Travel range limit inputs

This parameter displays the inputs of the travel range limit switches. The parameter is used for diagnostic purposes of the limit switches. The structure is as follows :

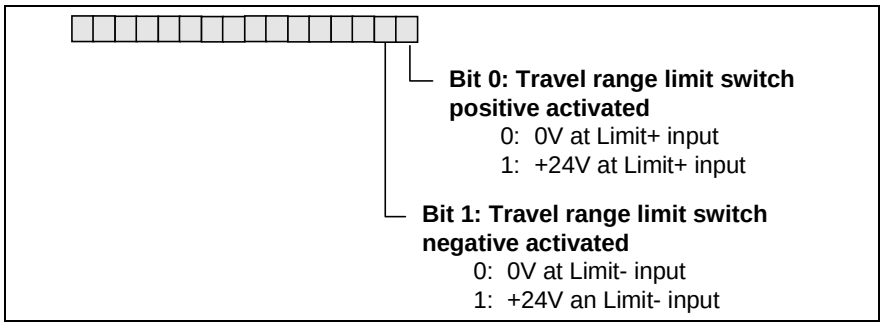

Bit 0: Travel range limit switch positive activated
0: 0V at Limit+ input
1: +24V at Limit+ input
Bit 1: Travel range limit switch negative activated
0: 0V at Limit- input
1: +24V an Limit- input

Fig. 3-34: Structure P-0-0222, Travel range limit inputs

See also the functional description: "Travel Zone Limit Switch Monitoring"

P-0-0222 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-0223, Status Input E-Stop function

This Parameter shows the state of the emergency stop input. The parameter can be used to read back the E-Stop input oder for display in a setup program.

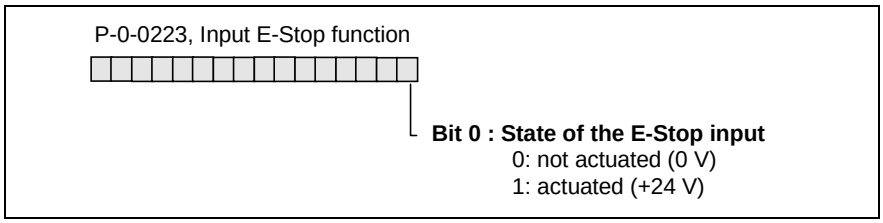


Fig. 3-35: Structure of the parameter P-0-0223, Input E-Stop function

For normal operation of the drive, the hardware input must be actuated with 24V.

See also the functional description: "Emergency stop feature"

P-0-0223 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	AT

P-0-0420, Analog output 1 signal selection

Using **P-0-0420, Analog output 1 signal selection**, an ID no. can be assigned to the analog AK1 output channel of the drive controller. The parameter with the assigned ID no. can be visualized with an oscilloscope in the form of an analog voltage. Only those ID no. which figure in the list **P-0-0426, Analog outputs, IDN list of assignable parameters** can be used.

See also the functional description: "Analog Output".

P-0-0420 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0421, Analog output 1, expanded signal selection

To be able to show signals as analog voltages, but which are not in **P-0-0426, Analog outputs, IDN list of assignable parameters**, then the option of an expanded signal select is possible. This becomes active as long as no parameter is assigned via **P-0-0420, Analog output 1 signal selection**.

The following expended signal select options are available:

- expanded signal select with permanently defind signals
- byte output
- bit output

1) Expanded signal selection with fixed signals

Internal signal numbers are assigned which are not in the drive in the form of ID numbers. These signals have permanent units making an evaluation via **P-0-0422, Analog output 1, scaling per 10V full scale** possible. The evaluation factor 1.0 equals the permanent unit.

The following permanently defined signals are possible:

Signal number P-0-0421	Output signal	Ref. Unit: scaling factor = 1.0
0x00000001	motor encoder sine signal	0.5V/10V
0x00000002	motor encoder cosine signal	0.5V/10V
0x00000003	Opt. enc. sine signal	0.5V/10V
0x00000004	Opt. enc. sine cosine	0.5V/10V
0x00000005	Position command difference on the pos. controler	rot. =>1000rpm/10V lin. =>100m/min/10V
0x00000006	DC bus power	1kW/10V
0x00000007	absolute DC bus power amount	1kW/10V
0x00000008	effective current	S-0-0110/10V
0x00000009	relative current	S-0-0110/10V
0x0000000a	thermal load	100%/10V, no scaling possible
0x0000000b	motor temperature	150°C/10V
0x0000000c	magnetizing current	S-0-0110/10V
0x0000000d	velocity command at the velocity controller	rot. => 1000rpm/10V lin. => 100m/min/10V

Fig. 3-36: Signal select list with predefined signal selection

The outputs are scaling dependent and always relate to the motor shaft given position and velocity data.

2) Byte output

It is possible herewith to output memory cells of the data memory as analog voltage. It can only be practically applied if the data storage structure is known. As this is, however, different from version to version, the the function can only be used by the respective developer. The function is activated by setting bit 28 in **P-0-0421, Analog output 1, expanded signal selection**. The adress of the memory cell is defined in the least significant 24 bit of the expanded signal selection.

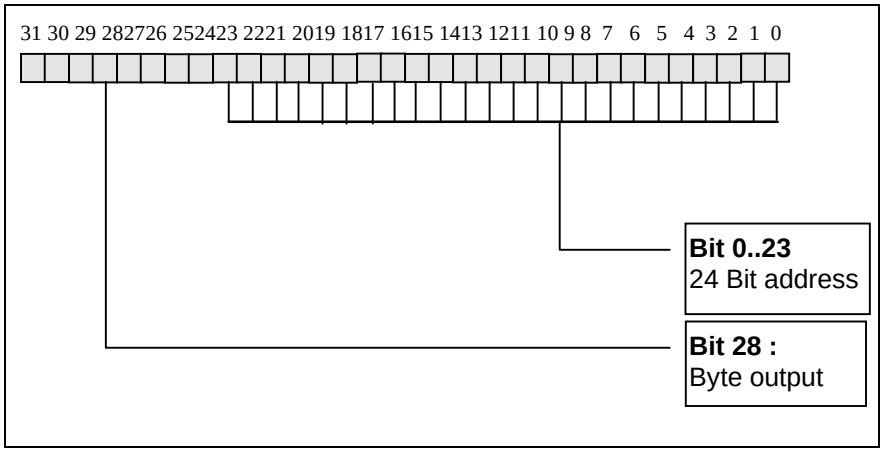


Fig. 3-37: Definition **P-0-0421, Analog output 1, expanded signal selection** with byte output

3) Bit output

Individual bits of the data memory can be shown as analog voltage herewith. If the respective bit is set, then 10V voltage is output at the analog output. A cleared bit outputs -10V. The function is activated by setting bit 29 and inputting the desired memory address in **P-0-0421, Analog output 1, expanded signal selection**.

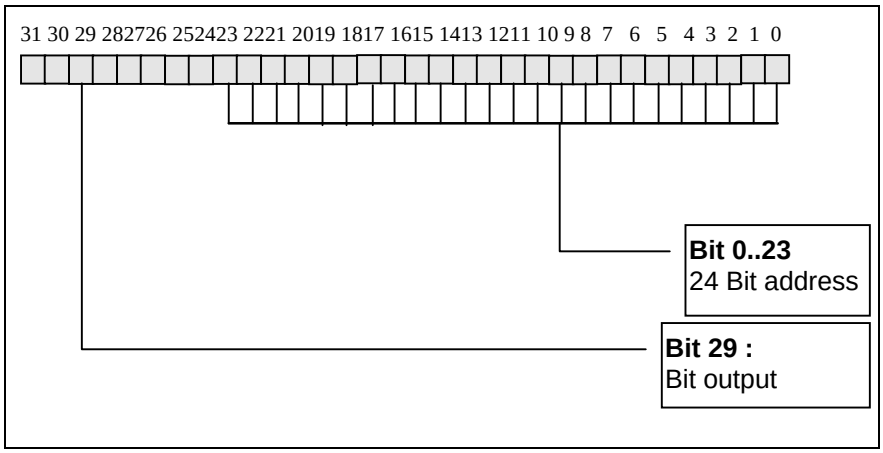


Fig. 3-38: Definition **P-0-0421, Analog output 1, expanded signal selection** with bit output

See also the functional description: "Analog Output".

P-0-0421 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0422, Analog output 1, scaling per 10V full scale

The resolution of the selected signal can be varied with parameter **P-0-0422, Analog output 1 scaling per 10V full scale**. If an ID no. is assigned via **P-0-0420, Analog output 1, signal selection**, the evalution is assigned the same unit as the parameter with the assigned ID number.

The output of pre-defined signals means that the scaling has a decimal factor of 4 decimal places. It has a permanent reference with fixed unit.

The scaling defines the least significant bit for bit and byte outputs. The input is decimal without decimal places.

See also the functional description: "Analog Output".

P-0-0422 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	---	**Memory:**	Param. EE
Format:	P-0-0420/P-0-0421	**Validity check:**	no
Unit:	P-0-0420/P-0-0421	**Extrem value check:**	no
Decimal places:	P-0-0420/P-0-0421	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0423, Analog output 2, signal selection

Using **P-0-0423, Analog output 2, signal selection**, an ID no. can be assigned to the analog AK2 output channel of the drive controller. The parameter with the assigned ID no. can be visualized with an oscilloscope in the form of an analog voltage. Only those ID no. which figure in the list **P-0-0426, Analog outputs, IDN list of assignable parameters** can be used.

See also the functional description: "Analog Output".

P-0-0423 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0424, Analog output 2, expanded signal selection

To be able to show signals as analog voltages, but which are not in **P-0-0426, Analog outputs, IDN list of assignable parameters**, then the option of an expanded signal select is possible. This becomes active as long as no parameter is assigned via **P-0-0423, Analog output 2 signal selection**.

The following expended signal select options are available:

- expanded signal select with permanently defind signals
- byte output
- bit output

1) Expanded signal selection with fixed signals

Internal signal numbers are assigned which are not in the drive in the form of ID numbers. These signals have permanent units making an evaluation via **P-0-0425, Analog output 2, scalling per 10V full scale** possible. The evaluation factor 1.0 equals the permanent unit.

The following permanently defined signals are possible:

Signal number P-0-0424	Output signal	Ref. Unit: scaling factor = 1.0
0x00000001	motor encoder sine signal	0.5V/10V
0x00000002	motor encoder cosine signal	0.5V/10V
0x00000003	Opt. enc. sine signal	0.5V/10V
0x00000004	Opt. enc. sine cosine	0.5V/10V
0x00000005	Position command difference on the pos. controler	rot. =>1000rpm/10V lin. =>100m/min/10V
0x00000006	DC bus power	1kW/10V
0x00000007	absolute DC bus power amount	1kW/10V
0x00000008	effective current	S-0-0110/10V
0x00000009	relative current	S-0-0110/10V

0x0000000a	thermal load	100%/10V no scaling possible
0x0000000b	motor temperature	150°C/10V
0x0000000c	magnetizing current	S-0-0110/10V
0x0000000d	velocity command at the velocity controller	rot. =>1000rpm/10V lin. => 100m/min/10V

Fig. 3-39: Signal select list with predefined signal selection

The outputs are scaling dependent and always relate to the motor shaft given position and velocity data.

2) Byte output

It is possible herewith to output memory cells of the data memory as analog voltage. It can only be practically applied if the data storage structure is known. As this is, however, different from version to version, the the function can only be used by the respective developer. The function is activated by setting bit 28 in **P-0-0424, Analog output 2, expanded signal selection**. The adress of the memory cell is defined in the least significant 24 bit of the expanded signal selection.

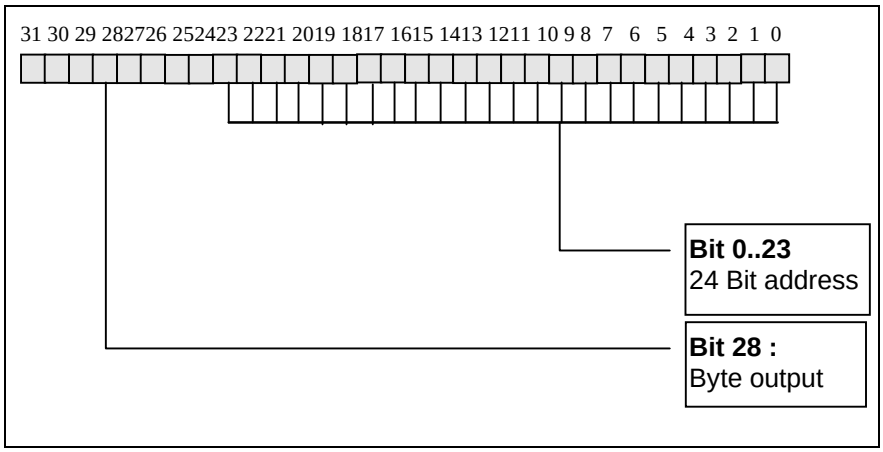


Fig. 3-40: Definition **P-0-0424, Analog output 2, expanded signal selection** with byte output

3) Bit output

Individual bits of the data memory can be shown as analog voltage herewith.If the respective bit is set, then 10V voltage is output at the analog output. A cleared bit outputs -10V. The function is activated by setting bit 29 and inputting the desired memory address in **P-0-0424, Analog output 2, expanded signal selection**.

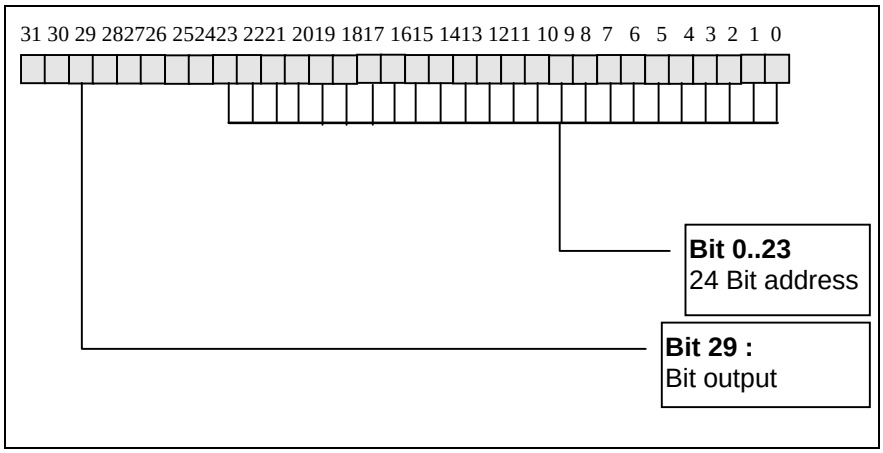


Fig. 3-41: Definition **P-0-0424, Analog output 2, expanded signal selection** with bit output

See also the functional description: "Analog Output".

P-0-0424 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0425, Analog output 2, scaling per 10V full scale

The resolution of the selected signal can be varied with parameter **P-0-0425, Analog output 2 scaling per 10V full scale**. If an ID no. is assigned via **P-0-0423, Analog output 2, signal selection**, the evalution is assigned the same unit as the parameter with the assigned ID number.

The output of pre-defined signals means that the scaling has a decimal factor of 4 decimal places. It has a permanent reference with fixed unit.

The scaling defines the least significant bit for bit and byte outputs. The input is decimal without decimal places.

See also the functional description: "Analog Output".

P-0-0425 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:		**Memory:**	Param. EE
Format:	P-0-0420/P-0-0421	**Validity check:**	no
Unit:	P-0-0420/P-0-0421	**Extrem value check:**	no
Decimal places:	P-0-0420/P-0-0421	**Combination check:**	no
Input min/max:	-- / --		
Default value:	0	**Cyc. transmittable:**	no

P-0-0426, Analog outputs, IDN list of assignable parameters

The parameter **P-0-0426, Analog outputs, IDN list of assignable parameters** contains a list of all parameters assignable via **P-0-0420, Analog output 1 signal selection** and **P-0-0423, Analog output 2, signal selection**.

Contents P-0-0426:

- **S-0-0036, Velocity command value**
- **S-0-0040, Velocity feedback value**
- **S-0-0047, Position command value**
- **S-0-0051, Position feedback 1 value**
- **S-0-0053, Position feedback 2 value**
- **S-0-0080, Torque/Force command**
- **S-0-0084, Torque/Force feedback value**
- **S-0-0134, Master control word**
- **S-0-0135, Drive status word**
- **S-0-0182, Manufacturer class 3 diagnostics**
- **S-0-0189, Following error**
- **S-0-0347, Speed deviation**
- **S-0-0383, Motor temperature**
- **S-0-0403, Position feedback value status**
- **P-0-0098, Max. model deviation**
- **P-0-0141, Thermal drive load**

See also the functional description: "Analog Output".

P-0-0426 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte var.	**Memory:**	constant
Format:	IDN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	---	**Cyc. transmittable:**	no

P-0-0502, Encoder emulation, resolution

Description:

IGS Emulation

If incremental encoder emulatoin is selected in **P-0-4020, Encoder emulation type** (**IGS**), then the number of lines of the simulated incremental encoder can be entered here.

Allowed values with IGS emulation are: **1 - 65536**

Note: It must be noted that the maximum output frequency of 1MHz is not exceeded!

SSI Emulation

If absolute encoder emulation (SSI) is set in **P-0-4020, Encoder emulation type**, then the bit width of the SSI position to be generated must be entered.

Allowed values with SSI emulation are: **8 - 24**

Also see function description: "Activatioin of encoder emulation"

P-0-0502 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	Cycles/Rev	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 65536		
Default value:	12	**Cyc. transmittable:**	no

P-0-0503, Marker pulse offset

With this parameter, the position of the reference pulse (zero pulse) of the emulated incremental encoder output can be shifted within one (electr. or mech.) turn.

See also functional description: "Encoder emulation".

P-0-0503 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Deg	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	no
Input min/max:	0 / 359.9999		
Default value:	0	**Cyc. transmittable:**	no

P-0-0508, Commutation offset

For synchronous motors, this parameter indicates the offset between the raw value of the motor encoder and the resulting absolute electrical angle between the stator current vector and the rotor flux vector.

For motors with motor feedback data memory, like MKD, the commutation offset is stored in the feedback and therefore does not need to be entered.

This value must always be redetermined, if

- the motor probe system encounters a change in its mechanical structure,
- A mechanical restructuring of primary and secondary portions takes place.

For asynchronous motors, this parameter has no meaning.

See also the functional description: "Synchronous-asynchronous".

P-0-0508 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	0	**Cyc. transmittable:**	no

P-0-0510, Moment of inertia of the rotor

This parameter indicates the moment of inertia of the rotor without load. For motors with feedback memory (e.g. MKD), it is saved in the feedback.

See also the functional description: "Motor Feedback-Data Memory".

P-0-0510 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	kgm²	**Extrem value check:**	no
Decimal places:	5	**Combination check:**	no
Input min/max:	1 / 10000000		
Default value:	0	**Cyc. transmittable:**	no

P-0-0511, Brake current

This parameter shows, how much current the brake in the connected motor needs.

P-0-0511 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0 / 500000		
Default value:	0	**Cyc. transmittable:**	no

P-0-0520, Hardware code

Parameter for identification of the hardware.

The parameter is determined during the manufacturing stage and cannot be changed.

P-0-0520 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-0523, Commutation, probe value

If the commutation offset for linear synchronous motors is to be set with the **P-0-0524, Commutation adjustment command**, then the setting probe value should be entered in the **P-0-0523, Commutation, probe value** parameter.

See also the functional description: "Determining the commutation offset".

P-0-0523 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	-2147483648 / 2147483647		
Default value:	---	**Cyc. transmittable:**	no

P-0-0524, D300 Commutation adjustment command

For synchronous kit motors and linear motors it is necessary to adjust for the commutation during the initial setup. The appropriate command can be started under following **conditions**:

- Operation mode = Torque Control
- Command Torque = 0
- Drive Enable = 1 (Rotary synchronous kit motor)
- Drive Enable = 0 (Linear synchronous kit motor)

After starting the command, the drive moves by itself a short distance forward and backward, thereby determining the commutation offset.

The command is cancelled by dropping the drive enable to 0.

For other synchronous motors with intrinsic feedback, e.g. MKD, the commutation offset is determined at the INDRAMAT works, and the customer cannot execute the command any more.

See also the functional description: "Determining the commutation offset".

P-0-0524 - Attributes

Function:	Command	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-0525, Type of motor brake

This parameter specifies whether an electrically released or electrically engaged brake is being used. If an **MHD** or **MDK** motor is used, then the brake will be electrically released, if there is one. The bit 0 will be set automatically to 0. If other motor types are used, this bit must be entered during the startup procedure.

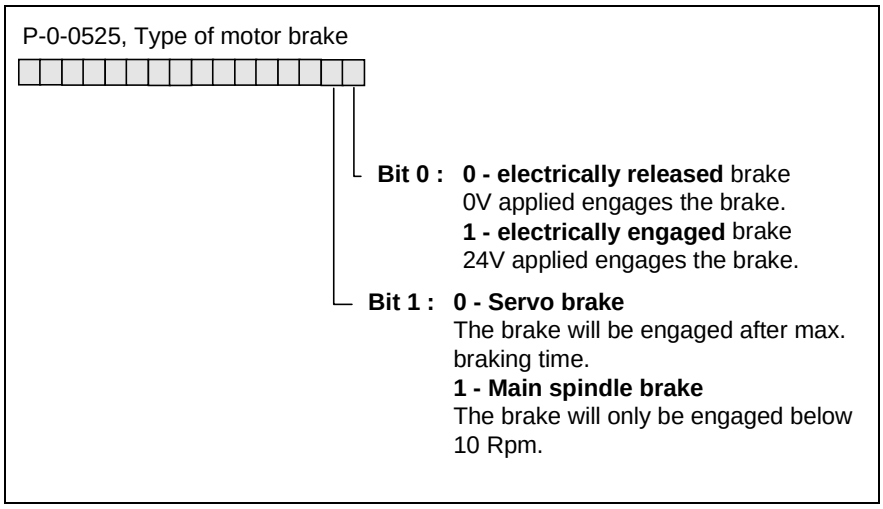

P-0-0525, Type of motor brake
Bit 0 : 0 - electrically released brake
0V applied engages the brake.
1 - electrically engaged brake
24V applied engages the brake.
Bit 1 : 0 - Servo brake
The brake will be engaged after max. braking time.
1 - Main spindle brake
The brake will only be engaged below 10 Rpm.

Fig. 3-42: Setting the type of motor brake

See also the functional description: "Motor Holding Brake".

P-0-0525 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 1		
Default value:	0	**Cyc. transmittable:**	no

P-0-0526, Brake control delay

If a holding brake is used, the time delay between the activation of the brake and the time when it gets its full force must be set in this parameter.

It must be sure that the drive is still electrically controlled as long as the brake does not grip firmly.

This value is entered automatically when MHD, MKD or MKE motors are used. When using Indramat brakes in conjunction with asynchronous motors, then the standard value to be entered is 150 ms.

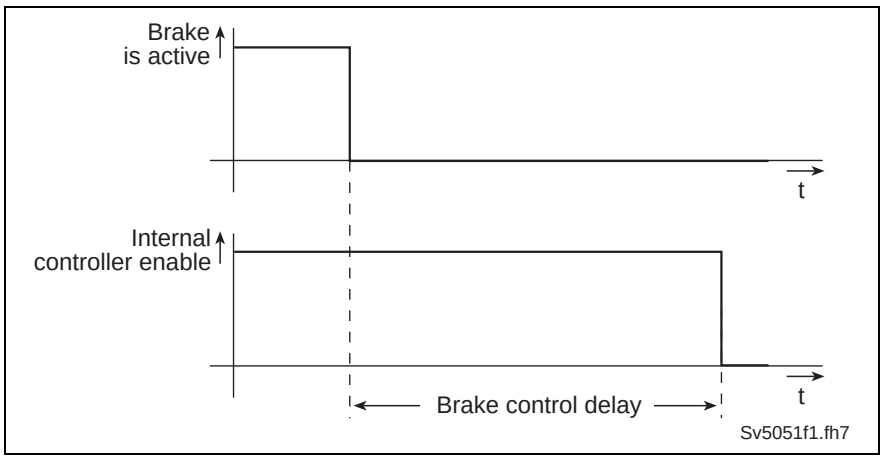


Abb. 3-43: Haltebremsen-Verzugszeit

See also the functional description: "Motor Holding Brake".

P-0-0526 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 100000		
Default value:	100	**Cyc. transmittable:**	no

P-0-0530, Slip increase

In an asynchronous motor, the rotor resistance and consequently the rotor time constant changes with the temperature. The slip increase compensates for this change.

The slip increase per 100K(elvin) is motor-specific and is specified by Indramat for each individual motor.

See also the functional description: "Asynchronous motors".

P-0-0530 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	1/100K	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	100 / 300		
Default value:	150	**Cyc. transmittable:**	no

P-0-0531, Stall current factor

The stall current limit is used to limit the peak current of the motor to reasonable values when operating at high velocities. Higher currents lead only to higher losses, not to more wave power.

This limit value is set by Indramat. If 0 is entered, the limit is inactive.

See also the functional description: "Asynchronous motors".

P-0-0531 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A/Vmin	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	0	**Cyc. transmittable:**	no

P-0-0532, Premagnetization factor

The pre-magnetization factor is used for application-dependent decreases in the Servo magnetization current. Together with parameter **P-0-4004, Magnetizing current**, it specifies the motor's magnetization current.

Effective magnetization current =

magnetization current • pre-magnetization scaling factor

With a pre-magnetizing factor of 100%, the Servo magnetization current in the motor will flow so that a torque proportional to the momentum-producing current will result in the basic rotation range.

See also the functional description: "Scaling factor pre-magnetizing".

P-0-0532 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	%	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	25 / 100		
Default value:	100	**Cyc. transmittable:**	no

P-0-0533, Flux loop prop. gain

The flux loop controls the magnetization current in the field-weakening range.

The parameter value is set by Indramat.

See also the functional description: "Asynchronous motors".

P-0-0533 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A/V	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	100 / 65535		
Default value:	500	**Cyc. transmittable:**	no

P-0-0534, Flux loop integral action time

The flux loop controls the magnetization current in the field-weakening range.

The parameter value is set by Indramat.

See also the functional description: "Asynchronous motors".

P-0-0534 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	6000	**Cyc. transmittable:**	no

P-0-0535, Motor voltage at no load

The motor voltage in the field-weakening range is set so that it reaches a value lower than or equal to the DC bus voltage.

Under load, the motor voltage will be raised to the maximum motor voltage.

See also the functional description: "Asynchronous motors".

P-0-0535 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	%Uzwk	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	500 / 1000		
Default value:	800	**Cyc. transmittable:**	no

P-0-0536, Motor voltage max.

The motor voltage in the field-weakening range is set so that it reaches a value lower than or equal to the DC bus voltage.

At full load, the motor voltage will rise to the maximum motor voltage. The output voltage will be sinusoidal up to a value of 90% .

See also the functional description: "Asynchronous motors".

P-0-0536 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	%Uzwk	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	500 / 1000		
Default value:	900	**Cyc. transmittable:**	no

P-0-0538, Motor function parameter 1

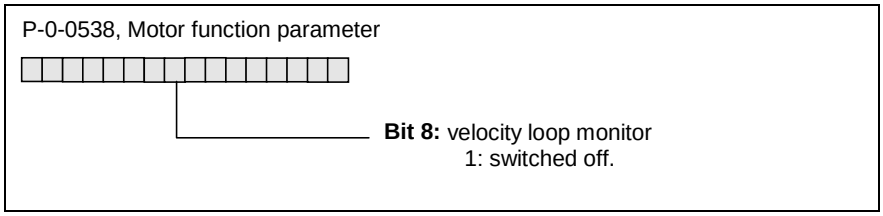


Fig. 3-44: P-0-0538, Motor function parameter

WARNING

Attention, danger for life! Danger of runaway axis!

If you switch off the velocity loop monitor, the drive does not survey any more whether the axis follows the velocity command values. E.g. with wrong parameters it can happen that the axis moves inadvertently.

See also the functional description: "Setting the Velocity Controller".

P-0-0538 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	BIN	**Validity check:**	Phase3
Unit:	---	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	yes
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-0612, Control word for setting absolute measurement

This parameter sets proceedings for the **P-0-0012, Command 'Set absolute measurement'**.

Parameter structure:

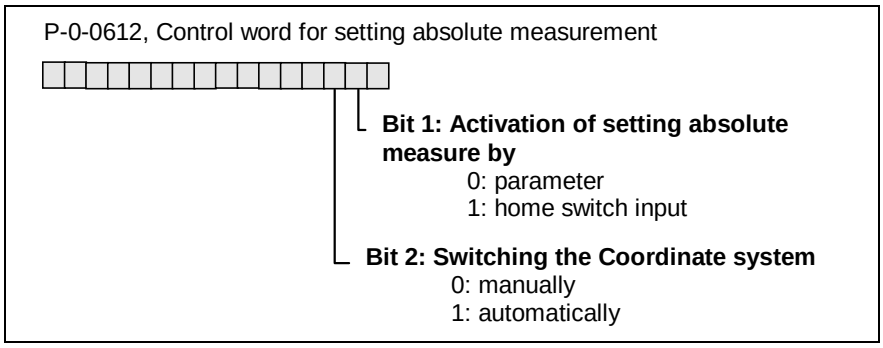

P-0-0612, Control word for setting absolute measurement
Bit 1: Activation of setting absolute measure by
0: parameter
1: home switch input
Bit 2: Switching the Coordinate system
0: manually
1: automatically

Fig. 3-45: P-0-0612, Control word for setting absolute measurement

See also the functional description: "Set absolute Measurement".

P-0-0612 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	-
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 7		
Default value:	-	**Cyc. transmittable:**	-

P-0-1201, Ramp 1 pitch

The parameter **P-0-1201, Ramp 1 pitch**, takes effect in

- "Velocity control" operating mode and
- during the **error response** "Velocity command value zero-switch with pitch and filter".

The acceleration and delay entered here are used to create a pitch starting from the last effective command value to the new command value.

In the Velocity control operating mode, the resulting velocity command value is derived from the sum of the value resulting from the pitch function in **S-0-0036, Velocity command value** and the direct value in **S-0-0037, Additive velocity command value**.

During the error response "Velocity command value, zero-switch with pitch and filter", velocity proceeds from the current feedback velocity to 0, using the effective velocity command value with the delay specified by the parameter in **P-0-1201, Ramp 1 pitch**.

Note: With the value in the parameter **P-0-1201, Ramp 1 pitch** = 0, the ramp is not active.

See also the functional description: "Velocity command value to zero with filter and ramp".

P-0-1201 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	0	**Cyc. transmittable:**	no

P-0-1202, Final speed of ramp 1

At the speed in the parameter **P-0-1202 Final speed of ramp1**, the slope of the drive internal speed command ramp changes from **Ramp 1 pitch (P- 0-1201)** to **Ramp 2 pitch (P-0-1203)**.

See also the functional description: "Velocity command value to zero with filter and ramp".

P-0-1202 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	0	**Cyc. transmittable:**	no

P-0-1203, Ramp 2 pitch

The parameter **P-0-1203, Ramp 2 pitch**, takes effect in

- "Velocity control" operating mode and
- during the error response "Velocity command value zero-switch with pitch and filter".

The acceleration and deceleration entered here are used to create a pitch starting from the last effective command value to the new command value, as long as the speed at the ramp output is higher than the value in the parameter **P-0-1202, Final speed of ramp 1**.

In the Velocity control operating mode, the resulting velocity command value is derived from the sum of the value resulting from the pitch function in **S-0-0036, Velocity command value** and the direct value in **S-0-0037, Additive velocity command value**.

During the error response "Velocity command value, zero-switch with pitch and filter", velocity proceeds from the current feedback velocity to 0, using the effective velocity command value with the delay specified by the parameter in **P-0-1203, Ramp 2 pitch**.

Note: With the value in the parameter **P-0-1201, Ramp 1 pitch** = 0, the ramp is not active.

See also the functional description: "Velocity command value to zero with filter and ramp".

P-0-1203 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3

Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	0 / 2147483647		
Default value:	0	**Cyc. transmittable:**	no

P-0-1222, Velocity command filter

The parameter **P-0-1222, Velocity command filter** works

- in the Velocity control operating mode and
- during the error response "Velocity command value zero-switch with slope and filter."

The time constant entered here is used in the velocity control operating mode to pass the value in **S-0-0036, Velocity command value** which has been pitched by **P-0-1201, Ramp 1 pitch**, through a deep-pass filter. This serves to diminish surges in acceleration over the course of command values.

The resulting velocity command value results from the sum of the sloped and filtered value in **S-0-0036, Velocity command value** and the direct value in **S-0-0037, Additive velocity command value**.

When error response "Velocity command value, zero-switch with pitch and filter" is executed, velocity proceeds from the current feedback velocity to 0, using the effective velocity command value with the delay specified by the parameter in **P-0-1201, Ramp 1 pitch**. It is also passes through the deep pass filter specified by **P-0-1222, Velocity command filter**.

See also the functional description: "Velocity command value to zero with filter and ramp".

P-0-1222 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 32767		
Default value:	0	**Cyc. transmittable:**	no

P-0-4000, Current-zero-trim phase U

This parameter serves to display the determined result of the zero-trim procedure for the current feedback sensor of phase U.

P-0-4000 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	%	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 10000		
Default value:	---	**Cyc. transmittable:**	no

P-0-4001, Current-zero-trim phase V

This parameter serves to display the determined result of the zero-trim procedure for the current feedback sensor of phase V.

P-0-4001 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_MV	**Validity check:**	no
Unit:	%	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 10000		
Default value:	---	**Cyc. transmittable:**	no

P-0-4002, Current-amplify-trim phase U

For trimming of the current sensor regarding its gain error, this parameter is determined in the test area for the Indramat drive controllers.

P-0-4002 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	---	**Cyc. transmittable:**	no

P-0-4003, Current-amplify-trim phase V

For trimming of the current sensor regarding its gain error, this parameter is determined in the test area for the Indramat drive controllers.

P-0-4003 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	---	**Cyc. transmittable:**	no

P-0-4004, Magnetizing current

This parameter indicates the nominal or servo-magnetization current set by Indramat **for asynchronous motors**. The magnetizing current actually flowing is also dependent on the premagnetization scaling factor.

For synchronous motors, e.g. MKD, this parameter is automatically set to 0.

See also the functional description: "Asynchronous motors".

P-0-4004 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	4Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	no
Input min/max:	0 / S-0-0110		
Default value:	7500	**Cyc. transmittable:**	no

P-0-4006, Process block target position

List of the target positions for the block operated function (positioning interface). You can input a maximum of 64 position values, whereby the first elemet specifies the target position of the process block 0, the second position specifies the target position of the process block 1, and so on.

The number of the target positions must always be greater or equal to the number of the operational process blocks. If a process block is selected for which there is no target position, then the warning „non-programmed process block" will be given.

See also the function description: "Positioning Block Mode".

P-0-4006 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Prog.-Modul
Format:	DEC_MV	**Validity check:**	P3-4
Unit:	S-0-0076	**Extrem value check:**	yes
Decimal places:	S-0-0077/S-0-0078	**Combination check:**	no
Input min/max:	S-0-0076 / S-0-0076		
Default value:	Defaultliste	**Cyc. transmittable:**	no

P-0-4007, Process block velocity

List of the process block velocities for the block operated function (positioning interface). You can input a maximum of **64** velocities, whereby the first element specifies the maximum velocity of the process block 0, the second element specifies the maximum velocity of the process block 1, and so on.

The number of the process block velocities must always be greater or equal to the number of operational process blocks. If a process block is selected of which there is no process block velocity, then the warning "non-programmed process block" will be given.

See also the function description: "Positioning Block Mode".

P-0-4007 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Prog.-Modul
Format:	DEC_MV	**Validity check:**	P3-4
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	Defaultliste	**Cyc. transmittable:**	no

P-0-4008, Process block acceleration

List of the accelerations for the block operated function (positioning interface). You can input a maximum of **64** acceleration values, whereby the first element specifies the maximum acceleration of the process block 0, the second element specifies the maximum acceleration of the process block 1, and so on.

The number of acceleration values must always be greater or equal to the number of operation process blocks. If a process block is selected of which there is no acceleration, then the warning „unprogrammed Process block" will be given.

See also the function description: "Positioning Block Mode".

P-0-4008 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Prog.-Modul
Format:	DEC_MV	**Validity check:**	P3-4
Unit:	S-0-0160	**Extrem value check:**	yes
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	S-0-0160 / S-0-0160		
Default value:	Defaultliste	**Cyc. transmittable:**	no

P-0-4009, Process block jerk

List of the jerk limit values for the block operated function (positioning interface). You can input a maximum of **64** jerk limit values, whereby the first element specifies the jerk limit value of the process block 0, the second element specifies the jerk value of the process block 1, and so on.

The number of the jerk limit values must be greater or equal to the number of operation process blocks. If a process block is selected of which there is no jerk value, then the warning „non-programmed process block" will be given.

With an input of **0**, the jerk limit can be turned **off**.

See also the function description: "Positioning Block Mode".

P-0-4009 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte var.	**Memory:**	Prog.-Modul
Format:	DEC_MV	**Validity check:**	P3-4
Unit:	S-0-0160	**Extrem value check:**	no
Decimal places:	S-0-0161/S-0-0162	**Combination check:**	no
Input min/max:	- / -		
Default value:	Defaultliste	**Cyc. transmittable:**	no

P-0-4010, Load inertia

The load moment of inertia determined with the automatic control loop setting is entered in this parameter, without **P-0-0510, rotor moment of inertia**. The knowledge of the load inertia is important when optimizing the velocity control loop.

Note: The inertia relates to the motor and is **rotary** in nature.

See also the functional description:"Automatic Control Loop Settings".

P-0-4010 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	kgm²	**Extrem value check:**	yes
Decimal places:	5	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4011, Switching frequency

This parameter is used to set the switching frequency of the pulse with modulation controller to **4 kHz or 8 kHz**.

See also the functional description: "Setting the Active Continuous Current".

P-0-4011 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	kHz	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	yes
Input min/max:	4 / 8		
Default value:	4	**Cyc. transmittable:**	no

P-0-4012, Slip factor

The slip factor is the most important parameter for asynchronous motors. It indicates the rotor frequency in relation to the torque-producing current. The lower the rotor time constant is, the higher the slip factor.

This parameter is set motor-specifically by Indramat.

See also the functional description: "Asynchronous motors".

P-0-4012 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	Hz/100A	**Extrem value check:**	yes
Decimal places:	2	**Combination check:**	no
Input min/max:	1 / 50000		
Default value:	600	**Cyc. transmittable:**	no

P-0-4014, Motor type

The motor type can be selected with this parameter. The following motor types are supported:

- 1: MHD
- 2: 2AD / 1MB with NTC sensor
- 3: LSF
- 4: LAR / LAF

- 5: MKD / MKE
- 6: 2AD /1MB with PTC sensor
- 7: synchronous kit motor

See also the functional description: "Setting of the Motor Type Through P-0-4014, Motor Type".

P-0-4014 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 7		
Default value:	1	**Cyc. transmittable:**	no

P-0-4015, Intermediate DC bus voltage

This parameter supports the display of the currently measured DC bus voltage.

P-0-4015 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	V	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1000		
Default value:	---	**Cyc. transmittable:**	no

P-0-4019, Process block mode

Setup of the process block mode for each separate process block.The first element of this list specifies the mode of the process block 0, the second specifies the mode of the process block 1, and so on.

process block mode	Setup value
Absolute process block	**1** h
relative process block without res. path storage	**2** h
relative process block with res. path storage	102 h
Movement in positive direction	4 h
Movement in negative direction	8 h
following block at target position without halt (mode 1)	10 h
following block at target position without halt (mode 2)	20 h
following block at target position with halt	40 h
following block with transition at switching signal	80 h

Fig. 3-46: Selectable process block modes

The number of the process block modes must always be greater or equal to the number of operational process blocks.

If a process block is selected of which there is no process mode, then the warning „non-programmed process block" will be given.

See also the functional description:"Positioning Block Mode".

P-0-4019 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte var.	**Memory:**	Prog.-Modul
Format:	HEX	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	-
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	Defaultliste	**Cyc. transmittable:**	no

P-0-4020, Encoder emulation type

The parameter gives the choice

- between **incremental or absolute** feedback position output as well as
- the **source** of the signal to emulate.

The following table shows the possible combinations:

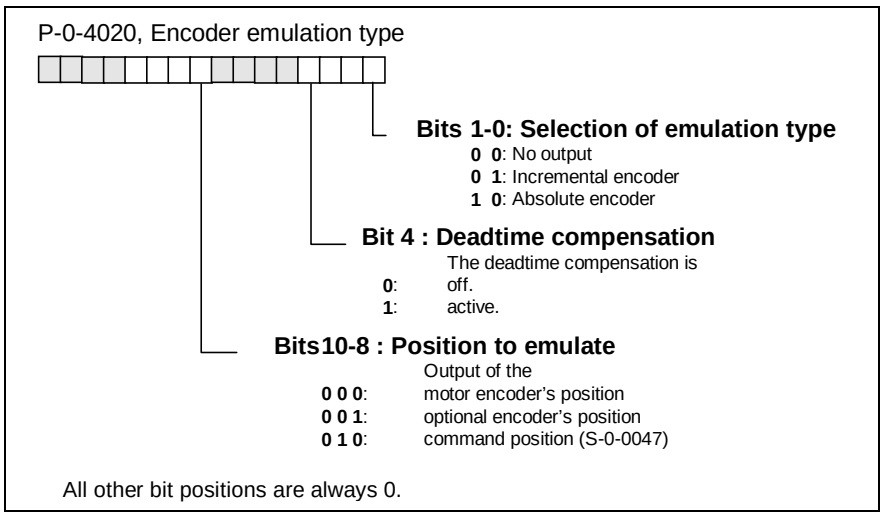

P-0-4020, Encoder emulation type
Bits 1-0: Selection of emulation type
0 0: No output
0 1: Incremental encoder
1 0: Absolute encoder
Bit 4 : Deadtime compensation
The deadtime compensation is
0: off.
1: active.
Bits10-8 : Position to emulate
Output of the
0 0 0: motor encoder's position
0 0 1: optional encoder's position
0 1 0: command position (S-0-0047)
All other bit positions are always 0.

Fig. 3-47: Parameter P-0-4020, Encoder Emulation Type

See also the functional description:"Encoder Emulation".

P-0-4020 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Prog.-Modul
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	-
Input min/max:	0 / 5		
Default value:	0	**Cyc. transmittable:**	no

P-0-4021, Baud rate RS-232/485

Various baud rates (transmission speeds) can be set for communications via the serial interfaces.

Baud rate [Baud]	Setting in parameter P-0-4021
9600	0
19200	1

Fig. 3-48: Settable baud rates



ATTENTION

⇒ All participants on the bus must be set to the same baud rate.

Note: Do not change the baud rate in the list of all parameters in *DriveTop*. Doing so would lock out all further communications in *DriveTop* versions < 3.

See also Supplement C: "Serial communications".

P-0-4021 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 3		
Default value:	0	**Cyc. transmittable:**	no

P-0-4022, Drive address

When communicating via **RS485** interface with more than one drive, every drive must have a different address, so that only the addressed drive responds.

Note: If you enter the into the communication parameter P-0-4022 the value 256, it's the address switches which determine the device address (1..99) for the serial communication (RSKO + SIS) and not the value 256.



ATTENTION

If you set the **address via the serial interface** instead of the switches, **only one drive** may be connected at a time.

Only as soon as the addresses are set, you can connect the entire bus.

See also Supplement C: "Serial communications".

P-0-4022 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 256		
Default value:	256	**Cyc. transmittable:**	no

P-0-4023, C400 Communication phase 2 transition

Switching command **from drive mode** or from phase 3 (P3) **to parameter mode**, Phase 2 (P2).

The command can only be processed when the drive enable is off.

See also the functional description: "Parametrization Mode - Operating Mode".

P-0-4023 - Attributes

Function:	Command	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	0	**Cyc. transmittable:**	no

P-0-4024, Test status

Gives information about the product advancement in the factory.

P-0-4024 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst.-E²prom
Format:	HEX	**Validity check:**	nicht
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4026, Process block selection

Description:

This parameter is used to select the position block to be traversed.

Note: **With the I/O mode** (P-0-4084=0xFF8x) the lower six bits of P-0-4026 are in P-0-4077, Fieldbus control word!

See also the functional description: "Positioning Block Mode".

P-0-4026 - Attributes

Function:	Parameter	**Editability:**	ja
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 63		
Default value:	-	**Cyc. transmittable:**	MDT

P-0-4030, Jog velocity

Limit value for the velocity during movement via the jog input. The value must be smaller than that in parameter **S-0-0091, Bipolar Velocity Limit** value.

The velocity of the motion will also be controlled by **S-0-0108, feed rate override** and - during motion with limited velocity - the maximum **Positioning speed (S-0-0259)**.

See also the functional description: "Operating Mode: Jogging".

P-0-4030 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	4Byte	**Memory:**	Prog.-Modul
Format:	DEC_MV	**Validity check:**	P3-4
Unit:	S-0-0044	**Extrem value check:**	yes
Decimal places:	S-0-0045/S-0-0046	**Combination check:**	no
Input min/max:	S-0-0044 / S-0-0044		
Default value:	100000	**Cyc. transmittable:**	no

P-0-4035, Trim-current

In this parameter, the current value is stored with which the **current measurement** of the drive control is precisely adjusted in the factory. This eliminates systematical errors in the current measurement. The value has no meaning to the user and **cannot be changed.**

P-0-4035 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst. EE
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	1 / 500000		
Default value:	---	**Cyc. transmittable:**	no

P-0-4044, Braking resistor load

With this parameter, you can read the average power dissipated in the braking resistance.

100% means here that the damping resistance is charged with its **continuous rated power**. For a safe operation, the load should be less than 80% . The value is very much smoothened (filtered).

In order to ensure if a processing cycle does not overload the braking resistance, the analog signal „bleeder load" must be considered.

P-0-4044 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	%	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4045, Active permanent current

This parameter shows how much current the drive can supply in the actual cmbination in continual operation. Multiplying with the **P-0-0051, torque constant** of the motor yields the continual operational torque.

With this current, the device is not overloaded. It is also the current to which the current limit reduces.

This parameter is calculated by the drive control during switching to the operating mode and is not changeable. Determining this limit is influenced by the following **current and torque limitations and settings**:

ID-Nr.	Name	Unit
S-0-0111	Motor continuous current at standstill 1)	A
S-0-0112	Amplifier nominal current	A
P-0-4058	Amplifier type data	
S-0-0092	Torque limit bipolar 2)	%

Fig. 3-49: Active continuous current, dependencies

Note: The continuous current at standstill of the motor is that value of which the percentage specifications pocess: it corresponds to 100%.

See also the functional description: "Setting the Active Continuous Current".

P-0-4045 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	A	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-4046, Active peak current

This parameter shows how much current the drive can supply in the actual combination **momentarily** (0.4 s). Multiplying with the **P-0-0051, torque constant** of the motor yields the momentary operation torque (i.e. for acceleration operations).

This parameter is calculated and preset by the drive control during switching to the operating mode. The dynamic current limiting reduces this value according to the load of the amplifier.

Determining this limit is influenced by the following **current and torque limitations and settings**:

ID-Nr.	Name	Unit
S-0-0109	Motor peak current	A
S-0-0110	Amplifier peak current	A
P-0-4058	Amplifier type data	
S-0-0092	Torque limit bipolar	%

Fig. 3-50: Active peak current, dependencies

See also the functional description: "Setting the active peak current".

P-0-4046 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	A	**Extrem value check:**	no
Decimal places:	3	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-0-4047, Motor inductance

Inductance of the motor, measured between two clamps.

The parameter is set at the factory and cannot be changed.

P-0-4047 - Attributes

Function:	Parameter	**Editability:**	-
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	-
Unit:	mH	**Extrem value check:**	-
Decimal places:	2	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

P-0-4048, Stator resistance

Stator resistance of the motor, measured between two connection clamps.

The parameter is set at the factory and cannot be changed.

P-0-4048 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedback-E²prom
Format:	DEC_OV	**Validity check:**	-
Unit:	Ohm	**Extrem value check:**	-
Decimal places:	3	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4050, Delay answer RS-232/485

The **RS-485** interface (bus capable) works in **half duplex** mode. The same pair of wires is used for both directions. The transmission direction must be switched during the data exchange. In oder to allow the connected devices (PC or PLC) a sufficient **time to switch between transmitting and receiving** on their side, the answer time of the drive can be set via this parameter.

P-0-4050 defines the minimal **time in milliseconds** that must pass after the last symbol of a telegram is received over the serial interface and before the first symbol of the response may be sent. For RS-232 operation, this parameter is not necessary.

The required response delay time is dependent on the Master/PC used. At shipping, the value for the answer delay is set to a value which satisfies most **PCs**.

Note: If communication problems arise, for example **"TIMEOUT" message** in DriveTop, then set the answer delay gradually to higher values, until the problems are gone. For safety, multiply the found limit value with the factor 1.5 and input it as answer delay.

See also Supplement C: "Serial communications".

P-0-4050 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Prog.-Modul
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	1 / 200		
Default value:	1	**Cyc. transmittable:**	no

P-0-4051, Process block acquittance

This parameter reflects the positioning command selection acquittance. It is also accessible in the hardware signals provided for this purpose.

At **Drive_Start = 0** (Drive Halt) the acquittance displays the preselected positioning command, **inverted** (complement), if controller enable = 1.

At **Drive_Start = 1** acquittance displays the current positioning command, and is **not inverted**, if it was accepted.

See also functional description "Positioning Block Mode".

P-0-4051 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	AT

P-0-4052, Positioning block, last accepted

This parameter stores the number of the last accepted positioning process block. This last process block number is also available after switching off and back on as the positioning block selection acquittance, as long as the drive enable has not been given.

See also the functional description "Positioning Block Mode".

P-0-4052 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Prog.-Modul
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4053, Intermediate DC bus voltage gain adjust

The **measurement of the DC bus voltage** must be adjusted during the fabrication.

The correction factor found during the adjustment process is stored permanently in the parameter P-0-4053.

P-0-4053 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst.-E²prom
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	--	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	no
Input min/max:	1 / 20000		
Default value:	-	**Cyc. transmittable:**	no

P-0-4054, Resolver input offset

The signal path for the resolver signals has an offset error. It is measured in the INDRAMAT test field, stored in this parameter and taken into account for the evaluation of the actual position in order not to influence the actual value.

The offset error of the encoder track 1 is stored in the low word, the offset error of the encoder track 2 is stored in the high word.

P-0-4054 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Verst.-E²prom
Format:	HEX	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	yes
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4055, Resolver input, amplitude adjust

The signal path for the resolver signals has a gain error. This error deviates the actual position value. The gain error is measured in the test field.

By compensating the gain error, the amplitudes of the resolver signals are matched together.

The value 0x4000H refers to a correction factor of 1.000 .

P-0-4055 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	HEX	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

P-0-4056, Jog inputs

This parameter shows the hardware inputs for jogging.

Bit 0 reflects the state of the Jog+ bit.

Bit 1 reflects the state of the Jog- bit.

Depending on the interface of the device, the bits come from hardware inputs or from a field bus.

Parameter P-0-4056	Inputs	Effect
00	Jog+ and Jog- = 0	no Jog direction selected
01	Jog+ = log. 1, Jog- = 0	positive Jog direction selected
10 binary	Jog+ = 0, Jog- = log. 1	negative Jog direction selected
11 binary	Jog+ and Jog- = log. 1	not allowed (Halt)

Fig. 3-51: Meaning of the Jog inputs

See also the functional description "Operating Mode: Jogging".

P-0-4056 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	0 / 3		
Default value:	-	**Cyc. transmittable:**	MDT

P-0-4057, Positioning block, input linked blocks

This parameter shows the hardware inputs for the operation with linked positioning process blocks.

Bit 0 reflects the state of the link block cam 1. 24V at the input means 1 in the bit 0.

Bit 1 reflects the state of the link block cam 2. 24V at the input means 1 in the bit 1.

Parameter P-0-4056	Bedeutung
0000000000000000	link block cam 1 and link block cam 2 = 0V
0000000000000001	link block cam 1 = 24V link block cam 2 = 0V
0000000000000010	link block cam 1 = 0V link block cam 2 = 24V
0000000000000011	link block cam 1 = 24V link block cam 2 = 24V

Fig. 3-52: Meaning of the Input for linked blocks

See also functional description:"Positioning Block Mode".

P-0-4057 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4058, Amplifier type data

In order to be ble to determined amplifier load the firmware must know the physical features of the amplifier.

Characteristics:

- transient thermal resistance
- continuous amplifier load
- thermal capacity

P-0-4058 - Attributes

Function:	Parameter	**Editability:**	Passw.
Data length:	4Byte var.	**Memory:**	Verst.-E²prom
Format:	HEX	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4059, Braking resistor data

To make the evaluation of the braking resistor (bleeder) load possibel, the firmware must know the physical properties of the braking resistor.

Technical data:

- Braking resistor peak power
- Braking resistor continuous power
- Max. allowed energy pulse, assuming that the pulse duration is so short, that no energy can be cooled down.

P-0-4059 - Attributes

Function:	Parameter	**Editability:**	Passw.
Data length:	4Byte var.	**Memory:**	Verst.-E²prom
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4060, Process block control word

This parameter contains relevant settings for the operation mode with process blocks. The parameter has the following structure :

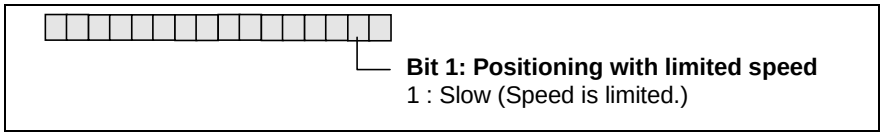


Fig. 3-53: Structure P-0-4060, Process block control word

See also the functional description:"Positioning Block Mode".

P-0-4060 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	Prog.-Modul
Format:	BIN	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	yes
Input min/max:	0 / 3		
Default value:	1	**Cyc. transmittable:**	no

P-0-4061, Mains voltage gain adjust

Using this parameter, the command communications (SERCOS, Profibus, ..) informs the drive about important control information on handling communication phase transitions as well as when releasing hardware inputs for -the drive enable and drive halt. Users cannot write access this parameter. It only supports diagnostics.

Parameter Structure:

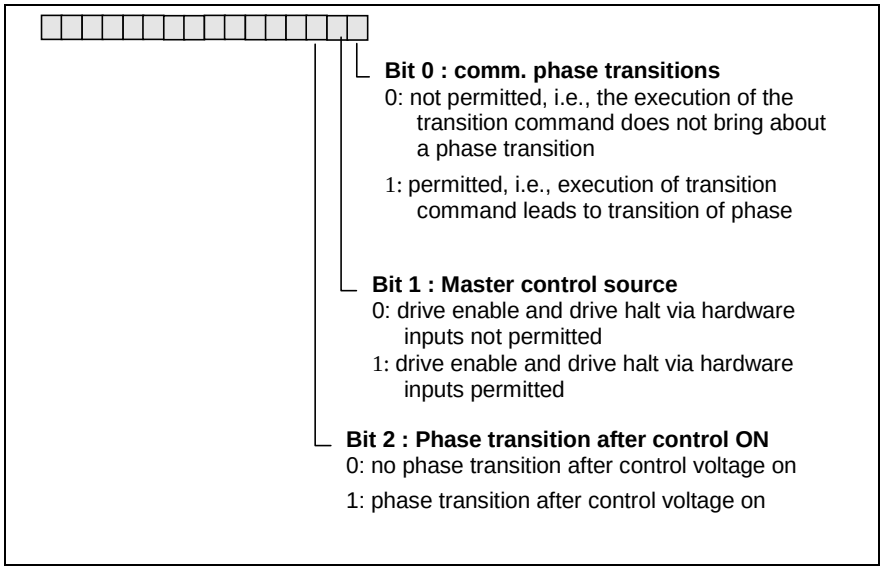

Bit 0 : comm. phase transitions
0: not permitted, i.e., the execution of the transition command does not bring about a phase transition
1: permitted, i.e., execution of transition command leads to transition of phase
Bit 1 : Master control source
0: drive enable and drive halt via hardware inputs not permitted
1: drive enable and drive halt via hardware inputs permitted
Bit 2 : Phase transition after control ON
0: no phase transition after control voltage on
1: phase transition after control voltage on

Fig. 3-54: P-0-4061, Mains voltage gain adjust

P-0-4061 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Verst.-E²prom
Format:	DEC_OV	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	yes
Decimal places:	4	**Combination check:**	-
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4062 Monitoring the Mains Section

This parameter can be used to monitor the activation or deactivation (Bit0 = 0) of an external power module. This is done via (Bit0 = 1).

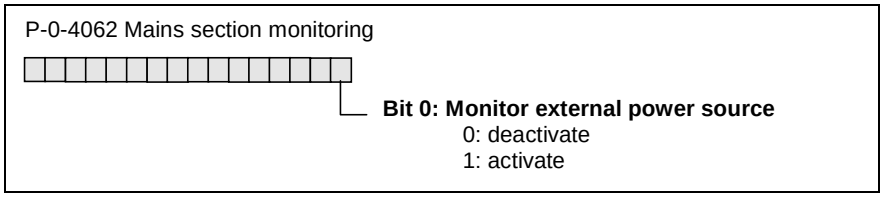


Fig. 3-55: Structure of P-0-4062

Note: The monitor evaluates the bb-mains section input (0V →error in power supply module).

P-0-4062 - Attributes

Function:	Parameter	**Editability:**	P23
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	BIN	**Validity check:**	P3-4
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 1		
Default value:	0	**Cyc. transmittable:**	no

P-0-4075, Fieldbus watchdog time

Parameter **P-0-4075, Fieldbus watchdog time** supports the setting of the monitoring time for the process data.

Note: At present the monitoring time for the process data can only be set with Interbus.

After each exchange of process data the time is restarted. At the end of this time, the error reaction set in the drive with parameter **P-0-0119, Best possible deceleration** is initiated.

Note: The value 65535 means that the monitor is off!

P-0-4075 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	ms	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4076, Fieldbus container object

Parameter P-0-4076 supports configuration of the process data channel in P-0-4080/P-0-4081. With fieldbusses that only support the same length of I/O data, this object must be used to fill up the shorter channel. With the Profibus/DP this object must be used to define the parameter channel.

see also: "**P-0-04080,Pos. corr., prec. corr. start position**"

see also: "**P-0-04081,Pos. corr., prec. corr. start position**"

P-0-4076 - Attributes

Function:	Parameter	**Editability:**	P234
Data length:	2Byte	**Memory:**	no
Format:	DEC_OV	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4077, Fieldbus control word

Parameter P-0-4077 supports the display of the control word transmitted via the fieldbus in the real time channel.

In this control word all the important **control information** of the profile is stored (e.g., IO mode, DriveCom Profile22,..)

- drive enable
- start/stop
- jog
- clear error.

Note: **P-0-4077,Fieldbus control word** is evaluated in terms of the fieldbus profile selected with P-0-4084. Parameter **P-0-4077, Fieldbus control word** only supports diagnostics.

See also function description: "Operating mode select code"

P-0-4077 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4078, Fieldbus status word

Parameter P-0-4078 supports the display of the status word transmitted via the fieldbus in the real time channel.

In this status word there is all important **status information** of the relevant profile (e.g., I/O mode, DriveCom Profile22,..)

- control and power section ready to operate
- drive error in C1D
- and so on.

Note: **P-0-4078,Fieldbus control word** is evaluated in terms of the fieldbus profile selected with P-0-4084. Parameter **P-0-4077, Fieldbus control word** only supports diagnostics.

See also function description: "Operating mode select code".

P-0-4078 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	keine	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4079, Fieldbus baudrate

Here, you can set the desired baudrate (bit rate) in steps of 0.1 kBaud, if the used fieldbus does not provide an automatic baudrate detection. If the chosen baudrate is not allowed, an appropriate standard baudrate for the fieldbus will be used. The actually used value will be written back into this parameter and can be read out for diagnostic purposes, e.g. with DriveTop.

P-0-4079 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	4Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	kBaud	**Extrem value check:**	yes
Decimal places:	1	**Combination check:**	no
Input min/max:	96 / 120000		
Default value:	100	**Cyc. transmittable:**	no

P-0-4080, Real-time input object structure

Description:

This parameter is used to configure the process input data channel (Slave→Master, i.e. "AT") regardless of the fieldbus used.

In parameter **P-0-4080, Real-time input object structure** only that operating data can be entered that is also listed in parameter **S-0-0187, List of configurable data in the AT**. Otherwise, transition command error **C106 Config. IDN for AT not configurable** is generated.

The fieldbus specific configuration of the real time data channel for the driection slave to master is generated out of parameter P-0-4080.

By reading out the fiedlbus specific objects or reading P-0-4080, the master can be informed about the individual real time data (parameter or objects) on the BUS.

Note: Changes in **P-0-4080** become effective after the drive runs up into operating mode.

P-0-4080 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	P2-3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	Defaultliste	**Cyc. transmittable:**	-

P-0-4081, Real-time output object structure

Description:

This parameter is used to configure the process output data channel (**Master→Slave**, i.e. "**MDT**") regardless of the fieldbus used.

In parameter **P-0-4081, Real-time output object structure** only that operating data may be entered which is also listed in parameter **S-0-0188, List of configurable data in the MDT.** Otherwise transition command error **C105 Configurated length > max. length for MDT** is generated.

Out of parameter P-0-4081 the fieldbus specific configuration of the real time data channel for direction master→slave is generated.

The master can obtain information about the individual real time data (parameter or objects) on the BUS by reading the fieldbus specific object or reading P-0-4081.

Note: Changes in **P-0-4081** become effective after the drive has run up into operating mode.

P-0-4081 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte var.	**Memory:**	-
Format:	IDN	**Validity check:**	P2-3
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	Defaultliste	**Cyc. transmittable:**	-

P-0-4082, Length of real-time data channel In

Description:

The number of Bytes of the process data channel from Slave → Master are specified here.

This length also contains the length of any present parameter channel. The graduation is specified in word limits, i.e., values allowed are 2, 4, 6 up to 32.

P-0-4082 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	P2-3
Unit:	Byte	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 32		
Default value:	2	**Cyc. transmittable:**	no

P-0-4083, Length of parameter channel in DP

Description:

Communication via a fieldbus on the one hand requires transmission of real time data – also known as process data – and also the transmission of parameters not bound to the real time cycle. For those fieldbusses that do not accomodate the transmission of parameters it is possible to exchange this data via an Indramat-specific parameter channel.

A parameter channel is only needed with a Profibus/DP and can only be configured there.

To configure a parameter channel within a process data channel it is always necessary that a value other than "0" is in **P-0-4083, Length of parameter channel in DP**. The input is in **Bytes**, whereby the following values are allowed: P-0-4083 ∈ [0,2, 4, 6,.... 12].

Note: The settings 0 or 12 are recommended. If "P-0-4083=0" is input then the parameter channel is switched off (default setting)!

P-0-4083 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	P2-3
Unit:	Byte	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 6		
Default value:	0	**Cyc. transmittable:**	no

P-0-4084, Profile type

Description:

With the setting of **P-0-4084, profile type**

- profile-dependent interpretation of control and status words,
- preselection of main operating modes set in the drive
- and real time data channel configuration (if not freely configurated)

are related!

Note: Changing **P-0-4084, profile type** does not become effective until the operating mode is switched into (phase 4).

the following settings are possible:

Operating mode	P-0-4084
position target (DRIVECOM Profile 22)	0x0001
velocity control 2 (DRIVECOM Profile 22)	0x0003
I/O - op. mode (compatible to DKC3.1)	0xFF80
I/O - op. mode (compatible to DKC3.1) + additionally configurable real time data	0xFF81
I/O - op. mode with cam status bits	0xFF82
drive-internal interpolation	0xFF91
cycle positon control	0xFF92
velocity control	0xFF93
freely configurable operationg (without profile)	0xFFFE

Fig. 3-56: Profile types that can be set

Note All manufacturer-specific selection codes are identified with 0xFFxx!

P-0-4084 - Attributes

Function:	Parameter	**Editability:**	P2
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	HEX	**Validity check:**	P2-3
Unit:	--	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	-
Input min/max:	0 / 32767		
Default value:	FF80	**Cyc. transmittable:**	no

P-0-4085, Fieldbus version

The **fieldbus firmware version** can be read from this parameter as plain text. The **structure** of the **firmware version** is defined as follows:

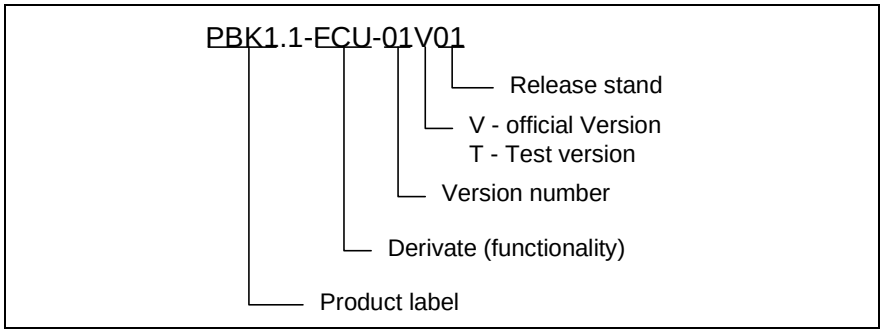


Fig. 3-57: Fieldbus version

Examples:

PBK1.1-FCU-01V01

PBK2.1-FCU-01V02

See also the functional description: "Firmware Overview".

P-0-4085 - Attributes

Function:	Parameter	**Editability:**	no
Data length:		**Memory:**	constant
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4086, Command communication status

Command communications (SERCOS, Profibus, ..) uses this parameter to inform the drive about important control information on handling communication phase transitions and for enabling hardware inputs for drive enable and drive halt.

Note: The user cannot write access this parameter. It only supports diagnostics.

Parameter structure:

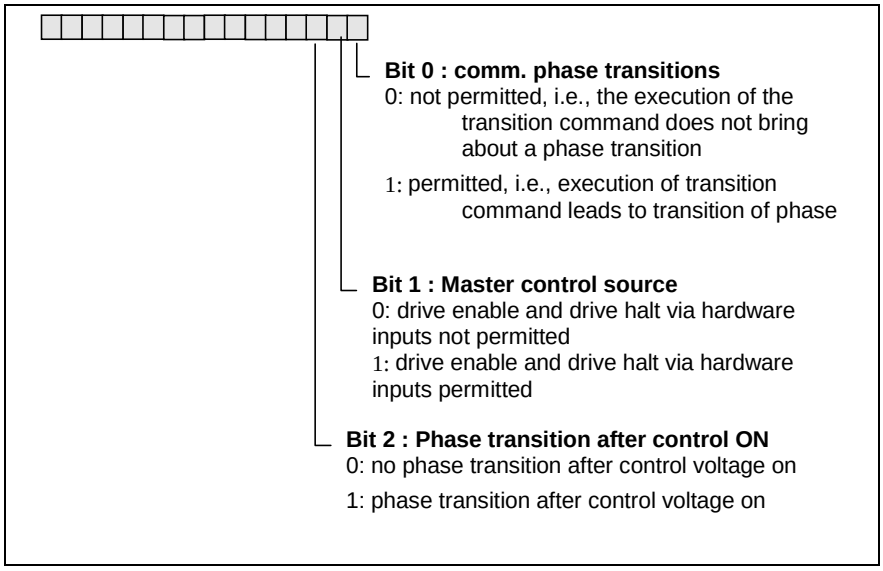

Bit 0 : comm. phase transitions
0: not permitted, i.e., the execution of the transition command does not bring about a phase transition
1: permitted, i.e., execution of transition command leads to transition of phase
Bit 1 : Master control source
0: drive enable and drive halt via hardware inputs not permitted
1: drive enable and drive halt via hardware inputs permitted
Bit 2 : Phase transition after control ON
0: no phase transition after control voltage on
1: phase transition after control voltage on

Fig. 3-58: P-0-4086, Command communication status

P-0-4086 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4087, Length of real-time data channel Out

Description:

The number of **bytes** of the **process data channel** from **Master → Slave** are set here.

This length contains the length of any existing **parameter channel** as well. The graduation is specified in word limits, i.e., allowable values are 2, 4 and 6 through to 32.

Note: Communicateions via Interbus is absolutely necessary due to bus structure (shift register) whereby **P-0-4082=P-0-4087**.

(Also see the parameter channel with fieldbusses.)

P-0-4087 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Param.-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	Byte	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 32		
Default value:	2	**Cyc. transmittable:**	no

P-0-4088, Serial number

Description:

The unit's serial number is stored in this parameter. The serial number is made up of a combination of material and continuous serial numbers.

In the event servicing is necessary, then material and serial numbers can be read here.

Serial number structure:

SN <6 place material number>-<6 place serial number>

Example: SN 276813-10021

P-0-4088 - Attributes

Function:	Parameter	**Editability:**	Passw.
Data length:	1Byte var.	**Memory:**	Verst.-E²prom
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4089, Production index

Description:

The finishing index of the drive controller is stored here. In the event servicing becomes necessary, the serial number can be read out for diagnostic purposes.

Example: **A01**

P-0-4089 - Attributes

Function:	Parameter	**Editability:**	Passw.
Data length:	1Byte var.	**Memory:**	Verst.-E²prom
Format:	ASCII	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	-	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-0-4094, C800 Command Base-parameter load

With the execution of this command, all parameters in **S-0-0192, IDN list of backup operation data** are set to their base values.

If the firmware in the prog. module is replaced with another version and the parameter memory is incompatible, then error **F209 PL Load parameter default values** is generated. “**PL**“ appears on the display. (At this time, the ser. interface is not yet active.)

Afterwards, execute the command by pressing the S1 button.

See also the functional description: "Basic parameter block".

P-0-4094 - Attributes

Function:	Command	**Editability:**	P23
Data length:	2Byte	**Memory:**	no
Format:	BIN	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	--	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-0004, Velocity loop smoothing time constant

The time constant that can be activated in this parameter acts on the velocity loop controller.

This is the default value from the feedback data memory. With the Basic Load procedure, the P-7-parameters are copied into the P-0-parameters.

See also the parameter description for P-0-0004.

P-7-0004 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	Phase3
Unit:	us	**Extrem value check:**	yes
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

P-7-0018, Number of pole pairs/pole pair distance

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the number of pole pairs of the motor.

P-7-0018 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	-
Unit:	pairs of poles/mm	**Extrem value check:**	-
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-0051, Torque/force constant

The Torque/Force constant indicates, how much torque or force the motor delivers at a certain real current.

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the torque constant of the motor.

P-7-0051 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	Nm/A	**Extrem value check:**	no
Decimal places:	2	**Combination check:**	no
Input min/max:	1 / 65535		
Default value:	---	**Cyc. transmittable:**	no

P-7-0508, Commutation offset

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the commutation offset of the motor. The commutation offset contains the angle of the rotor in relation to the motor encoder.

P-7-0508 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:		**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	0 / 65535		
Default value:	---	**Cyc. transmittable:**	no

P-7-0510, Moment of inertia of the rotor

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the moment of inertia of the motor's rotor.

P-7-0510 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	kgm²	**Extrem value check:**	no
Decimal places:	5	**Combination check:**	no
Input min/max:	1 / 10000000		
Default value:	---	**Cyc. transmittable:**	no

P-7-0511, Brake current

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the brake current of the motor.

P-7-0511 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	A	**Extrem value check:**	yes
Decimal places:	3	**Combination check:**	no
Input min/max:	0 / 500000		
Default value:	---	**Cyc. transmittable:**	no

P-7-0513, Feedback type 1

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the kind and type of the feedback.

P-7-0513 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-0514, Absolute encoder offset

For motors with feedback data memory, e.g. MKD, this parameter shows the value stored there for the absolute encoder offset. This value is changed by the command **P-0-0012, C300 Command 'Set absolute measurement**.

P-7-0514 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	Incr	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-0517, Feedback type 2

For optional encoder with feedback data memory, this parameter shows the value stored there for the kind and type of the feedback 2.

P-7-0517 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedback-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	no

P-7-4028, Impulse wire feedback - offset

The offset of the impulse wires referred to the resolver is saved in this parameter. It is messured in the factory and stored in the feedback memory.

P-7-4028 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	DEC_OV	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-4029, Impulse wire feedback - PIC counter value

This parameter contains the information of the absolute position of the encoder.

The value is updated at every position initialization. The value is read-only and cannot be edited by the user.

P-7-4029 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	4Byte	**Memory:**	Feedb. EE
Format:	HEX	**Validity check:**	no
Unit:	--	**Extrem value check:**	no
Decimal places:	0	**Combination check:**	no
Input min/max:	--- / ---		
Default value:	---	**Cyc. transmittable:**	no

P-7-4047, Motor inductance

Inductance of the motor, measured between two clamps.

This is the value from the feedback data memory. During Basic Load, the P-7 parameters are copied into the P-0 parameters.

The parameter is set at the factory and cannot be changed.

P-7-4047 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	Feedback-E²prom
Format:	DEC_OV	**Validity check:**	no
Unit:	mH	**Extrem value check:**	no
Decimal places:	2	**Combination check:**	no
Input min/max:	0 / 655.35		
Default value:	---	**Cyc. transmittable:**	no

P-7-4048, Stator resistance

Stator resistance of the motor, measured between two connection clamps.

This is the value from the feedback data memory. During Basic Load, the P-7 parameters are copied into the P-0 parameters.

The parameter is set at the factory and cannot be changed.

P-7-4048 - Attributes

Function:	Parameter	**Editability:**	no
Data length:	2Byte	**Memory:**	-
Format:	DEC_OV	**Validity check:**	-
Unit:	Ohm	**Extrem value check:**	-
Decimal places:	3	**Combination check:**	no
Input min/max:	- / -		
Default value:	-	**Cyc. transmittable:**	-

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ECODRIVE03
Drive for General Automation
with Fieldbus-Interfaces

Supplement B
Diagnostic Message Description
FGP 02VRS

DOK-ECODR3-FGP-02VRS**-FKB1-EN-P

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Notes

1 Diagnostic Message Descriptions

1.1 Overview of the diagnostic message descriptions

Diagnostic Message Types

Each operational state of the drive will be characterized with a diagnostic message.

Differentiations will be made between:

- **Error diagnostic messages**
- **Warning diagnostic messages**
- **Command diagnostic messages**
- **Drive Mode diagnostic messages**
- **Operation status**

Construction of a diagnostic message

A diagnostic message consists of:

- **A diagnostic number** and a
- **diagnostic text**

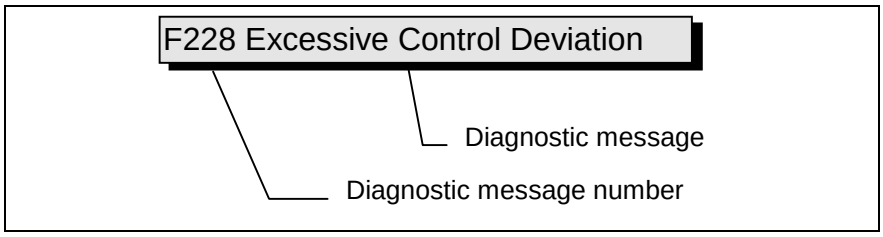


Fig. 1-1: Diagnostic message with a diagnostic number and text.

For the example in the graphic, "F2" and "28" are shown alternately on the H1-Display.

The control system can read out the diagnostic number in hexadecimal form with the **S-0-0390, Diagnostic message number** parameter.

In addition, the drive allocates to the control system the diagnostic number and diagnostic text as a string **F228 Excessive deviation** with the **S-0-0095, Diagnostic message** parameter.

H1-Display

The H1-Display serves as an optical display of the diagnostic message on the drive.

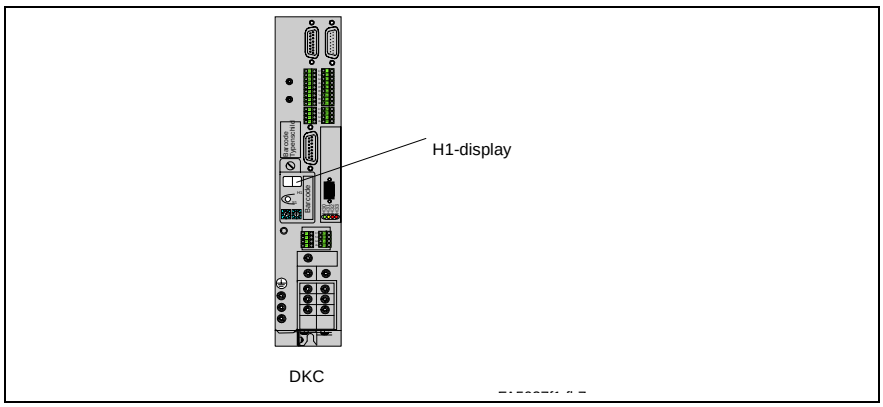


Fig. 1-2: H1-/Display

The diagnostic number appears on this two-positional seven-segment display. The image can be seen on the "Diagnostic Message Priority Display".

This display quickly shows the current operation status without the use of a communications interface.

The operating mode cannot be seen from the H1-Display. If the drive follows the operating mode and no command was activated, then the symbol "AF" appears on the display.

Diagnostic Message Output Priority

If more than one diagnostic message is waiting, then the message with the highest priority will be displayed.

The following graphic classifies operation status in order of importance.

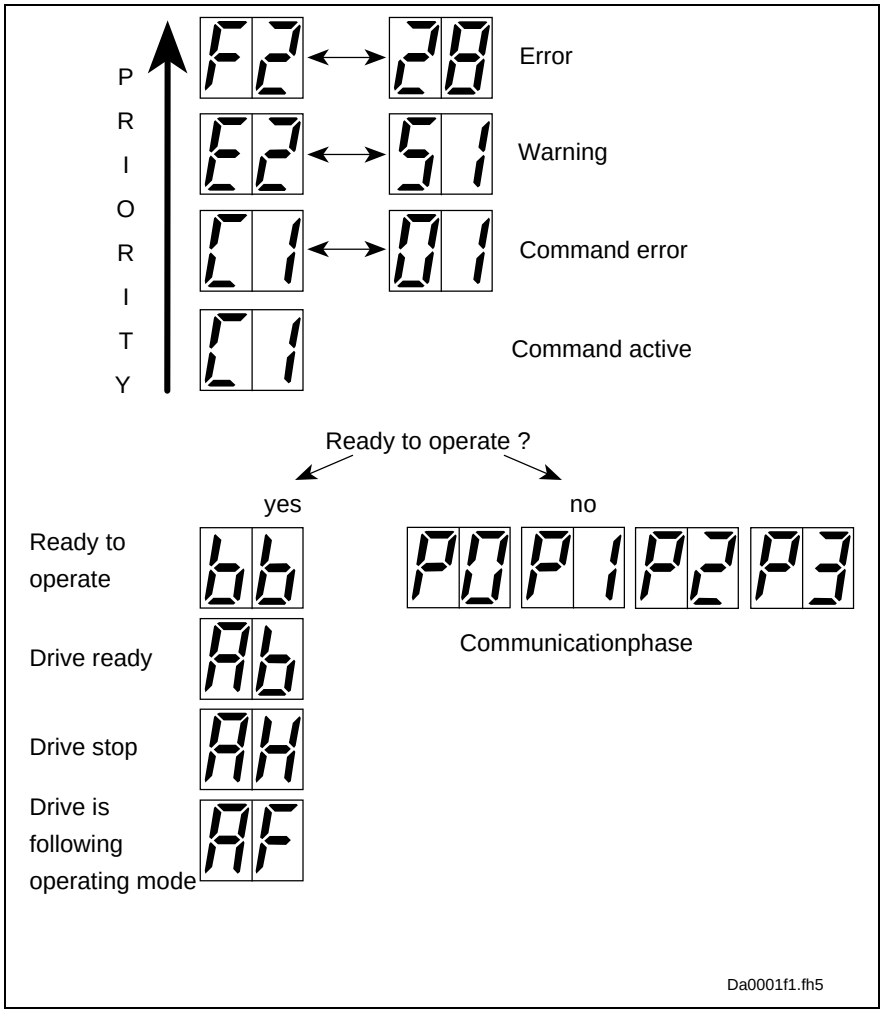


Fig. 1-3: Diagnostic message priority diagram

Clear Coded Diagnostic Message

The clear coded diagnostic message contains the diagnostic number followed by the diagnostic text, as shown in the example, "Excessive Output Error" (Fig. 1-1). It can be read out with the **S-0-0095, Diagnostic message** parameter and directly displays the operation status on an operator surface.

The clear coded diagnostic message will be switched to the current language.

1.2 Differences between Error Classes

Error diagnostic messages F...

Many areas are monitored in connection with operating modes and parameter settings. An error message is generated if a condition is discovered which no longer allows proper operation.

Error Classes

The errors are separated into four different error classes. The error class is evident from the diagnostic message. They are determined with the drive's error response.

Error class :	Diagnostic Message:	Drive Reaction:
Fatal	F8xx	Torque free switching
Travel range	F6xx	Velocity command value-zero switch
Interface	F4xx	In accordance with best possible deceleration
Non-fatal	F2xx	In accordance with best possible deceleration

Fig. 1-4: Error Classes and Drive Reaction

Drive's Error Reaction

If an error state is detected in the drive then an automatic operation of the drive's error response will be started as long the drive is in control. The H1 display blinks a Fx / xx.

The drive's reaction can be parameterized by **P-0-0119, Deceleration as best as possible**, with interface and non-fatal errors. At the end of each error reaction the drive is switched off.

Reset the Error

Errors will not be automatically deleted but must be:

- Reset from the control through the initialization of the command **S-0-0099, Reset Class 1 Diagnostics**, or
- reset by pressing the **"S1"** button.

If the error state is still present then the error will be immediately detected again.

A positive edge bit on the control enable signal is necessary in order to turn on the drive again.

1.3 Command Diagnostic Messages C... and D

The commands are used for control of complex features in the drive.

For example, the features "drive controlled homing procedure" or "Communication Phase 4 Transition Check" are defined as commands.

Commands can start, interrupt or erase a primary control.

A parameter belongs to each command whereby the command can be controlled by the parameter.

During the command operation, the diagnostic message "Cx" appears in the H1 display where the x stands for the number of the command.

It can distinguish between 3 types of commands.

Command Types

- **Drive Commands**
  - Lead to an eventual automatic drive movement
  - Can be started only through an inputted control enable
  - Deactivates the active operating mode during its operation
- **Monitor Commands**
  Activation or deactivation of monitors or features
- **Management Commands**
  - Lead management tasks that are not interruptable

1.4 Error diagnostic messages

F207 Switching to uninitialized operation mo de

Cause:

0 has been selected in at least one of the four mode parameters **S-0-0032..35**. This mode has been selected by the bits 8 and 9 in the master control word while the drive controller was on.

Remedy:

Enter the desired mode in the activated mode parameter.

Examples for possible modes are:

Meaning:	**Bit list of the mode parameters:**
Torque control	0000 0000 0000 0001
Velocity control	0000 0000 0000 0010
Position control with act. feedback val. 1	0000 0000 0000 x011
Position control with act. feedback val. 2	0000 0000 0000 x100
Drive-internal interpolation with actual feedback value 1	0000 0000 0001 x011
Drive-internal interpolation with actual feedback value 2	0000 0000 0001 x100
Relative drive-internal interpolation with actual feedback value 1	0000 0010 0001 x011
Relative drive-internal interpolation with actual feedback value 2	0000 0010 0001 x100

Fig. 1-4: Operation Modes

Which operation modes can be selected in a certain device is written in the description for the operation mode parameters:

Parameter:	Primary mode of operation	S-0-0032
	Secondary operation mode 1	S-0-0033
	Secondary operation mode 2	S-0-0034
	Secondary operation mode 3	S-0-0035

Check for input of the permissible interpolation method.

See also the functional description: "Setting the operating mode parameters"

F207 - Attributes

H1 Display : F2/07

Mess. no.: F207 (hex)

Error no: 207

Class: Not fatal

F208 UL The motor type has changed.

This indication happens when you power up for the first time with a new motor.

The regulator settings for the current, velocity and position loops are stored in the feedback on the motor. After powering up, the drive compares the motor type stored in the parameter with the connected

motor type. If the two do not match, basic control loop settings must be adapted, too.

With the Basic Load command, the default control loop settings are loaded from the feedback memory into the drive. The previous loop settings are overwritten. By pressing the S1 key, the command Basic Load is started.

Causes:

- The motor has been exchanged.
- A parameter file has been loaded, but the parameter **S-0-0141, Motor type** contained a motor type different from the present one.

Remedy:

Command **C700 Basic Load** or press the S1 button.

See also the functional description: "Automatic execution of the load default feature".

F208 - Attributes

H1 Display :	UL
Mess. no.:	F208 (hex)
Error no:	208
Class:	Not fatal

F209 PL Load parameter default values

After replacing the firmware version, the drive displays "**PL**", if the parameters have been changed in regards to the old product. By pressing the S1 button on the drive controller or by starting the command "load basic parameters", all the parameters will be erased and restored with the default (initial) values.

Cause:

The firmware has been exchanged; the number of parameters in comparison to the old product has changed.

Remedy:

Press S1 button on the drive controller, and all the parameters will be erased and restored with the factory preset default values



WARNING

⇒ This overwrites all parameters and positioning blocks.

See also the functional description: "Basic parameter block".

F209 - Attributes

H1 Display :	PL
Mess. no.:	F209 (hex)
Error no:	209
Class:	Not fatal

F218 Amplifier overtemp. shutdown

The temperature of the amplifier's heatsink is monitored. If the heatsink is too hot, the drive will power down in order to protect against damage.

Cause:

1. Ambient temperature too high. The specified performance data are valid up to an ambient temperature of 45°C.
2. The amplifier's heatsink is dirty.
3. Air flow is prevented by other assembly parts or the control cabinet assembly.
4. Blower defective

Remedy:

For 1. Reduce the ambient temperature, e.g. through cooling of the control cabinet.

For 2. Remove obstructions or dirt from the heatsink.

For 3. Install the device vertically and clear a large enough area for proper heatsink ventilation.

For 4. Exchange drive.

F218 - Attributes

H1 Display :	F2/18
Mess. no.:	F218 (hex)
Error no:	218
Class:	Not fatal

F219 Motor overtemp. shutdown

The motor temperature has risen to an unacceptable level.

As soon as the **temperature error threshold** of 155°C is exceeded, the drive will immediately be brought to a standstill as set in the error reaction (P-0-0119, best possible standstill).

It applies:

temperature warning threshold < temperature error threshold

See also **E251 Motor overtemperature warning**.

Cause:

1. The motor is **overloaded**. The effective torque demanded from the motor has been above its allowable continuous torque level for too long.
2. **Wire break**, ground short or short circuit in the motor temperature monitor line

3. **Instability** in the velocity loop

Remedy:

For 1. Check the installation of the motor. If the system has been in operation for a long time, check to see if the the operating conditions have changed. (in regards to pollution, friction, moved components, etc.)

For 2. Check wires and cables to the motor temperature monitor for wire breaks, earth short and short circuits.

For 3. Check velocity loop parameters.

See also the functional descripton: "Temperature Monitoring"

F219 - Attributes

H1 Display : F2/19

Mess. no.: F219 (hex)

Error no: 219

Class: Not fatal

F220 Bleeder overload shutdown

1. The regenerated energy from the mechanism of the machine via the motor has exceeded the capability of the braking resistor (bleeder). By exceeding the maximum energy of the resistor, the drive will shutdown according to the set error reaction, thereby protecting the bleeder from temperature damage.

Cause:

The reflected energy from the machine's mechanism over the motor is too great.

Remedy:

With too much power → reduce the acceleration value.

With too much energy → reduce the velocity.

Check the drive installation.

May require installation of an additional bleeder module.

2. The bleeder resistor is used as a charging resistor to load the DC bus capacitors.

Cause:

If a power failure has been programmed as a warning, then the softstart of the mains section can be started (controller turned on via the bleeder resistor on the mains). If the control does not bring the installation to a standstill once this warning is issued (the drive continues to receive power from the mains), then the bleeder monitor could be triggered.

Remedy:

- Set both power failure and undervoltage as a fatal warning. Then the drive prevents power input from the mains.
- The control switches the installation/machine off as soon as this warning is generated.
- Parametrize undervoltgage as an error, then the drive switches the machine off with the error reaction which has been set.

See also the functional description: "Current Limit".

F220 - Attributes

H1 Display : F2/20

Mess. no.: F220 (hex)

Error no: 220

Class: Not fatal

F221 Motor temp. surveillance defective

Cause:

Wire break or interruption in the wires for the motor temperature monitoring.

Remedy:

Check the wiring for the motor temperature monitoring (signals MT(emp)+ and MT(emp)-) for interruption and short circuit.

See also the functional description: "Temperature monitoring".

F221 - Attributes

H1 Display : F2/21

Mess. no.: F221 (hex)

Error no: 221

Class: Not fatal

F226 Undervoltage in power section

The level of the DC bus voltage is monitored by the drive controller. If the DC bus voltage falls below a minimal threshold, the drive independently shuts down according to the set error reaction.

Cause:

1. The power source has been interrupted without first switching off the drive enable (RF).
2. Disturbance in the power supply

Remedy:

For 1. Check the logic regarding the activation of the drive within the connected control.

For 2. Check the power supply.

The error can be cleared by removing the drive enable signal.

See also the functional description: "drive enable"

F226 - Attributes

H1 Display : F2/26

Mess. no.: F226 (hex)

Error no: 226

Class: Not fatal

F228 Excessive deviation

When the position loop is closed, the drive monitors whether it is able to follow the specified command value. This is done by calculating a model position value in the drive and comparing that value with the actual feedback value. If the difference between theoretical and actual position value permanently exceeds the value of the **S-0-0159, Monitoring window** parameter, the drive oviously cannot follow the given command value. Then this error is generated.

Cause:

1. The drive's **acceleration** capacity has been exceeded.
2. The axis is **blocked**.
3. Incorrect parameter values set in the drive parameters.
4. Incorrect parameter values in **S-0-0159, Monitoring window**.

Remedy:

Ref. 1. Check the **S-0-0092, Bipolar torque/force limit value** parameter and set it to the maximum permissible value of the application. Reduce the specified acceleration value from the controller (see controller Manual).

Ref. 2. Check the mechanical system and eliminate jamming of the axis.

Ref. 3. Check the drive parameters (control loop tuning).

Ref. 4. Set the parameter values of **S-0-0159, Monitoring window**.

See also the functional description "Position control loop monitoring".

F228 - Attributes

H1 Display : F2/28
Mess. no.: F228 (hex)
Error no: 228
Class: Not fatal

F229 Encoder 1 failure: quadrant error

With wrong signals in the encoder evaluation, a hardware error has been discovered in the encoder interface 1 being used.

Cause:

1. Defective encoder cable
2. Disruptive electro-magnetic interference on the encoder cable
3. Defective encoder interface
4. Defective drive controller

Remedy:

For 1. Exchange the encoder cable.
For 2. Keep the encoder cable well away from the power cables.
For 3. Exchange the encoder interface.
For 4. Exchange the drive controller.

F229 - Attributes

H1 Display : F2/29
Mess. no.: F229 (hex)
Error no: 229
Class: Not fatal

F230 Max. signal frequency of encoder 1 exceeded

The signal frequency of the encoder 1 (motor encoder) is checked whether the allowed max. frequency of the encoder interface is exceeded.

If the frequency is higher than allowed, the error **F230, Max. signal frequency of encoder 1 exceeded** is generated. The position status of the encoder 1 is cleared to 0.

F230 - Attributes

H1 Display : F2/30
Mess. no.: F230 (hex)
Error no: 230
Class: Not fatal

F236 Excessive position feedback difference

Cause:

In the communication phase 4 transition check command, position feedback value 1 and position feedback value 2 are set to the same value, and the cyclic evaluation of both encoders is started. In cyclic operation (phase 4), the position feedback difference of both encoders is compared with **S-0-0391, Monitoring window feedback 2**. If the

amount of the difference exceeds the monitoring window, the error F236 Excessive position feedback difference is diagnosed, the parameter-selected error response is performed, and the reference bits of both encoders are cleared.

Notes: The monitoring is off, when the parameter S-0-0391, Monitoring window feedback 2 is set to the value 0.

Possible Causes :

1. Incorrect parameter for the encoder 2
   (**S-0-0115, Position feedback 2 type parameter, S-0-0117, Resolution of feedback 2**)
2. Incorrect parameter setting of mechanical system between motor shaft and encoder 2:
   (S-0-0121, Input revolutions of load gear,
   S-0-0122, Output revolutions of load gear,
   S-0-0123, Feed constant)
3. The mechanical system between motor shaft and encoder 2 is not rigid (e.g. gear play).
4. Defective encoder cable
5. Maximum input frequency of the encoder interface exceeded
6. Encoder 2 (optional) is not mounted to the driven axis.
7. Incorrect reference measure of an absolute encoder

Remedy:

Ref. 1. Check **S-0-0115, Position feedback 2 type parameter** and **S-0-0117, Resolution of feedback 2**.

Ref. 2. Check **S-0-0121, S-0-0122, Input/Output revolutions of load gear** and **S-0-0123, Feed constant**.

Ref. 3. Increase **S-0-0391, Monitoring window feedback 2**.

Ref. 4. Replace encoder cable.

Ref. 5. Reduce the velocity.

Ref. 6. Set **S-0-0391, Monitoring window feedback 2** to 0 (de-activate monitoring function).

Ref. 7. Perform **P-0-0012, C300 Command 'Set absolute measurement'**.

See also the functional description "Actual feedback value monitoring".

F236 - Attributes

H1 Display :	F2/36
Mess. no.:	F236 (hex)
Error no:	236
Class:	Not fatal

F237 Excessive position command difference

Cause:

When the drive is operating in position control, incoming position command values are monitored. If the velocity required of the drive by two successive position command values is greater than or equal to the value in **S-0-0091, Bipolar velocity limit value**, position command value monitoring is initiated. The **Excessive position command value** is stored in parameter **P-0-0010**. The **last valid position command value** is stored in parameter **P-0-0011**.

If position data are to be processed in modulo format, then the interpretation of the command is also dependent on the value set in **S-0-0393, Command value mode for modulo format.** The parameter should be set for the "shortest path" (0).

Remedy:

Compare S-0-0091, Bipolar velocity limit value with the velocity in the program and adjust to match it, if necessary.

F237 - Attributes

H1 Display : F2/37

Mess. no.: F237 (hex)

Error no: 237

Class: Not fatal

F242 Encoder 2 failure: signal too small

Cause:

The analog signals of an external measurement system are used for high resolution analysis of that measurement system. These are monitored according to two criteria:

1. The pointer length, which is calculated from the sine and cosine signals, must be at least 1 V.
2. The maximum pointer length resulting from the sine and cosine signals must not exceed 11.8 V.

$$\text{pointerlength} = \sqrt{\sin^2 + \cos^2}$$

Fig. 1-5: Pointer length

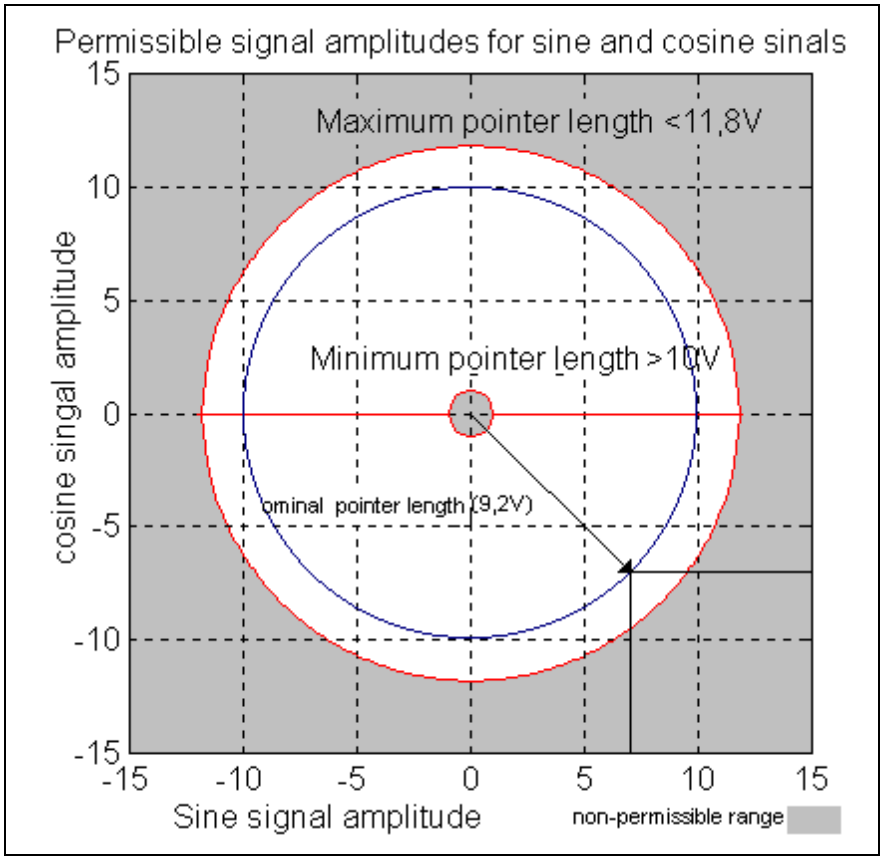


Fig. 1-6: Correct signal amplitude

Example:

Ucos = -6.5V

Usin = 6.5V

$$\text{pointerlength} = \sqrt{(-6.5V)^2 + 6.5V^2} \approx 9.2V$$

Remedy:

1. Check the measurement system cable.
2. Check the measurement system.

F242 - Attributes

H1 Display : F2/42

Mess. no.: F242 (hex)

Error no: 242

Class: Not fatal

F245 Encoder 2 failure: quadrant error

The evaluation of the additional optional encoder (encoder 2) is active. In the evaluation of the sinusoidal input signals of the optional encoder, a plausibility check is performed between these signals and the counter fed by these signals. Doing this, an error has been encountered.

Cause:

1. Defective encoder cable
2. Disruptive electro-magnetic interference on the encoder cable
3. Defective encoder interface

Remedy:

For 1. Exchange the encoder cable.

For 2. Keep the encoder cable well away from power cables.

For 3. Exchange the encoder interface (DIAX) or the device (Ecodrive).

F245 - Attributes

H1 Display : F2/45

Mess. no.: F245 (hex)

Error no: 245

Class: Not fatal

F246 Max signal frequency of encoder 2 exceeded

The signal frequency of the encoder 2 (optional encoder) is checked whether the allowed max. frequency of the encoder interface is exceeded.

Whether, in the case of an excessive frequency, the error F246, Max signal frequency for encoder 2 exceeded is generated or not, depends on the setting in the parameter **P-0-0185, Function of encoder 2**. If the number 4 for spindle encoder is set there, only the position status of the optional encoder is cleared to 0. In the other case, the warning **F246** is generated and the position status is cleared to 0.

F246 - Attributes

H1 Display : F2/46

Mess. no.: F246 (hex)

Error no: 246

Class: Not fatal

F248 Low battery voltage

Cause:

For motors of series MKD and MKE, the absolute position information is stored by a battery-powered electronic in the motor feedback. The battery is designed for a 10-year life span. If the battery voltage falls below 2.8 V, this message appears. The absolute encoder function will still be preserved for about 2 weeks.



CAUTION

Malfunction in the control of motors and moving elements

Possible damages: Mechanical injuries

⇒ Replace the battery as soon as possible.

Instructions for Exchanging Batteries

Have the following tools and accessories ready:

- Torx screwdriver size 10
- Needle-nose pliers, torque wrench
- New packaged battery (Part No. 257101)



CAUTION

Malfunction in the control of motors and moving elements

Possible damages: Mechanical injuries

⇒ Turn off the power supply. Make sure it will not be turned back on. Exchange the battery while the control voltage (24V) is turned on.

If the control voltage is turned off while the battery is taken out, the absolute **reference** point will be lost. Then, the reference point must be reestablished with the command "**Set absolute measuring**".

Removing the Battery

- Unscrew torx screws with size 10 screwdriver.
- Pull out the resolver feedback (RSF) lid by hand.
- Pull off the battery connector.
- Loosen battery clamp and remove the battery.
- Place the prepared battery in the housing and screw on the clamp. **Attention!** Do not kink or clamp the battery cable.
- Attach the connector of the battery.

Close the resolver feedback lid, screw in 4 torx screws and tighten to 1.8 Nm with the torque wrench.

F248 - Attributes

H1 Display :	F2/48
Mess. no.:	F248 (hex)
Error no:	248
Class:	Not fatal

F253 Incr. encoder emulator: pulse frequency too high

Cause:

The incremental encoder emulator can process a maximum of 2047 lines per sample period 500 µs; this value has been exceeded.

Remedial action:

1. Reduce the **number of lines** of the incremental encoder emulator (P-0-0502).

or

2. Reduce the travel **velocity**.

See also the functional description: "Encoder Emulation".

F253 - Attributes

H1 Display : F2/53
Mess. no.: F253 (hex)
Error no: 253
Class: Not fatal

F262 External short at status outputs

Status outputs are monitored for short circuits and thermal overload.

- If output current exceeds 350mA for about 1µs, then this is acknowledged as a short circuit and the pertinent channel is shut off. The output remains off unti the error is cleared.
- With thermal overload, the error is set and the output(s) shut off. After the driver has cooled off, the outputs are switched back on and so on. The error, however, remains until it is cleared. Thermal overload can occur if several outputs are overloaded in excess of 80 mA.

Note: Light bulbs, for example, cannot be controlled as their inrush current causes a short-circuit.

Cause:

1. Short circuited outputs (X2/6, X2/7, X2/8, X2/9, X2/10, X2/20, X2/21, X2/22)
2. One or more outputs are overloaded.

Remedy:

For 1. Eliminate short circuit or limit switching current (< 350 mA)

For 2. Drop current, depending on output, to < 80 mA.

See also the functional description: "Setting the Operating Mode Parameters".

F262 - Attributes

H1 Display : F2/62
Mess. no.: F262 (hex)
Error no: 262
Class: Not fatal

F267 Erroneous internal hardware synchronization

Cause:

The drive control is synchronized on the bus interface (SERCOS, Profibus, Interbus, ...). The correct fuction of the synchronization is

monitored. If the average value of the deviation exceeds 5 µs, this error is generated.

Remedy:

Replace drive controller.

F267 - Attributes

H1 Display : F2/67
Mess. no.: F267 (hex)
Error no: 267
Class: Not fatal

F276 Absolute encoder out of allowed window

When turning off the drive controller with an absolute encoder (multiturn), the actual feedback position will be stored. When powered up, the absolute position given by the encoder is compared with the stored position.

Notes: If the deviation is greater than the paramaterized **P-0-0097, Absolute Encoder Monitoring Window**, the error **F276** will appear and be given to the control system.

Cause:

1. Turning on for the first time (invalid stored position)
2. The motor has been moved further than allowed by the parameter in the absolute encoder monitoring window, P-0-0097, while it was turned off.
3. Incorrect position initialization

Remedy:

For 1. Press S1 to reset the error and set the absolute position.

For 2. The motor was moved while turned off and sits outside of its permissible position. Check to see if the displayed position is correct in relation to the machine zero point. Reset subsequent errors.

For 3. **An accident may occur by accidental shaft movement.** Check absolute position information. The feedback is defective if the absolute position information is wrong. The motor should be exchanged and sent to the INDRAMAT Customer Service.

See also Function Description "Absolute Encoder Monitoring".

F276 - Attributes

H1 Display : F2/76
Mess. no.: F276 (hex)
Error no: 276
Class: Not fatal

F277 Current measurement trim wrong

The current reading in the drive controller is compensated for during operation. The compensation values are stored in parameters P-0-4000 and P-0-4001. These values are queried to ensure they maintain the tolerance of +/- 10 %. Should the values be greater, then the error is generated.

Cause:

1. Hardware defective in the drive controller.

Recovery:

1. Replace hardware.

F277 - Attributes

H1 Display :	F2/77
Mess. no.:	F277 (hex)
Error no:	277
Class:	Not fatal

F281 Mains fault

Cause:
The power supply voltage was not present during operation for at least 3 power periods. As a result, the drive controller was brought to a standstill according to the set error response.

Remedy:

Check the power supply connection according to the project planning specifications.

F281 - Attributes

H1 Display :	F2/81
Mess. no.:	F281 (hex)
Error no:	281
Class:	Not fatal

F386 No ready signal from supply module

Cause:

Input BbN "mains section ready“ on the drive controller is at 24V, i.e., the connected mains section is not issuing a ready to operate signal.

Recovery:

1.) Check mains section.

2.) Check connection from mains section to BbN input on drive.

3.) If the drive does not have a separate power section, then switch the input monitor off.

See also **P-0-4062, Monitoring the Mains section**

See also the functional description: "Current Limit"

F386 - Attributes

H1 Display :	F3/86
Mess. no.:	F386 (hex)
Error no:	386
Class:	Not fatal

F402 Double MDT failure shutdown

The master data telegram used for internal communications (MDT) between both controllers has not been received in the drive over the course of two sequential fieldbus cycles.

Cause:

1. There is interference in the internal communications between the two controllers.
2. The fieldbus master is no longer cyclically sending telegrams to the drive. They are, however, being cyclilcally expected in phase 4.

Recovery:

1. Replace interface module (e.g., PBK, CAN,...) in the drive.
2. Switch master on and initiate cyclilcal communications. See Control Manual.

F402 - Attributes

H1 Display :	F4/02
Mess. no.:	F402 (hex)
Error no:	402
Class:	Interface

F407 Error during initialisation of master communication

While initializing and checking the command communications interface **between the drive and fieldbus processor,** can error occurred.

Note: This error cannot be cleared and the drive remains in Phase2. It is possible to parametrize the axis and conduct a firmware update with DOLFI. The axis can be run, however!

Cause:

Error **F407, Error during fieldbus initialized** is entered if

- no command communications card has been inserted
- an incorrect command communications card has been inserted
- the fieldbus firmware does not run (timeout)
- an error occurred when programming the PBK flash

Recovery:

- insert correct card
- replace firmware

F407 - Attributes

H1 Display :	F4/07
Mess. no.:	F407 (hex)
Error no:	407
Class:	Interface

F408 Fatal error of the interface card

The fieldbus interface has detected a fatal error.

Cause:

1. The watchdog of the interface card has been triggered.
2. A non-permitted memory access follows.

Recovery:

Switch unit off and on and if error still pending, replace hardware.

F408 - Attributes

H1 Display : F4/08

Mess. no.: F408 (hex)

Error no: 408

Class: Interface

F409 Bus failure

After the fieldbus has been initialized and everything is running, the watdchdog of the fieldbus was triggered, i.e,. communications with the fieldbus master is no longer possible.

Cause:

1. The fieldbus card connector has been pulled.
2. The fieldbus cable is faulty.
3. The master is not sending a telegram.

Recovery:

On 1. Ensure that the fieldbus card connector is correctly inserted.

On 2. Check fieldbus cable for faults.

On 3. Check master.

F409 - Attributes

H1 Display : F4/09

Mess. no.: F409 (hex)

Error no: 409

Class: Interface

F410 Synchronization with field bus impossible

A connection to the drive cannot be established in profile type „cyclical position control“.

Cause:

1. The cycle time of the fieldbus was incorrectly set.
2. Sercos cycle time (S-0-0002) was incorrectly set.
3. The fieldbus is only active during synchronization.

Recovery:

On 1 and 2. The cycle time of the fieldbus and Sercos cycle time must have the correct ratio. As the Sercos cycle is derived from the fieldbus cycle time the Sercos cycle must either be adapted in the event of an error (cycle time of the fieldbus is fixed) or vice versa (Sercos cycle fixed).

On 2. In drive phase 3 it is attempted to synchronize Sercos cycle of drive to cycle time of fieldbus. This takes some time. If the connection to the master should be interrupted during this synchronization phase, then the fieldbus card cannot established synchronization and the connection to the master cannot be interrupted.

F410 - Attributes

H1 Display : F4/10

Mess. no.: F410 (hex)

Error no: 410

Class: Interface

F434 Emergency-Stop

Pressing the emergency stop switch (E-Stop) has caused the drive to perform the emergency stop function that was selected in the **P-0-0119, Best possible deceleration** parameter. Setting bit 15 of **S-0-0011, Class 1 diagnostics** causes an error message to be issued to the controller.

Cause:

The emergency stop switch has been pressed.

Remedy:

Eliminate the malfunction that has caused the emergency switch to be actuated, and clear the error.

See also the functional description: "Emergency stop feature".

F434 - Attributes

H1 Display :	F4/34
Mess. no.:	F434 (hex)
Error no:	434
Class:	Interface

F629 Positive travel limit exceeded

The drive has received a command value which has led to an axis position outside the positive travel range. The axis has been brought to a standstill with the error response "Set velocity command value to zero".

Bit 2 of paramater **P-0-0090, Travel limit parameter** is set for "Exceeding travel range is an error", or after exceeding the position limit a drive control command has been started (such as the drive-controlled homing procedure).

Cause:

S-0-0049, Positive position limit value exceeded.

Remedy:

1. Check **S-0-0049, Positive position limit value**
2. Check the software limits of the control system
3. Activate the axis after the error response

Procedure:

- Clear the error.
- If the power supply was turned off, turn it back on.
- Move the axis into the permissible working range.

Note: Only such command values will be accepted which lead back into the allowed working range. With other command values, the drive will stop again. - The parameter **S-0-0057, Position window** defines a hysteresis for the travel limits.

See also the functional description: "Axis limit values".

F629 - Attributes

H1 Display :	F6/29
Mess. no.:	F629 (hex)
Error no:	629
Class:	Nr. 1

F630 Negative travel limit exceeded

The drive has received a command value which has led to an axis position outside the negative travel range. The axis has been brought to a standstill with the error response "Set velocity command value to zero".

Bit 2 of paramater **P-0-0090, Travel limit parameter** is set for "Exceeding travel range is an error", or after exceeding the position limit a drive control command has been started (such as the drive-controlled homing procedure).

Cause:

S-0-0050, Negative travel limit value exceeded.

Remedy:

1. Check **S-0-0050, Negative travel limit value**.
2. Check the software limits of the control system.
3. Activate the axis after the error response.

Procedure:

- Clear the error.
- If the power supply was turned off, turn it back on.
- Move the axis into the permissible working range.

Note: Only such command values will be accepted which lead back into the allowed working range. With other command values, the drive will stop again. - The parameter **S-0-0057, Position window** defines a hysteresis for the travel limits.

See also the functional description: "Travel Range Limits".

F630 - Attributes

H1 Display : F6/30
Mess. no.: F630 (hex)
Error no: 630
Class: Travel range

F634 Emergency-Stop

Pressing the emergency stop (E-Stop) switch has caused the drive to stop by setting the velocity command value to zero. An error is reported in the **S-0-0011, Class 1 diagnostics** parameter.

Cause:

The emergency stop switch has been pressed.

Remedy:

Eliminate the malfunction that has caused the emergency switch to be actuated, and clear the error.

See also the functional description: "Emergency stop feature".

F634 - Attributes

H1 Display : F6/34
Mess. no.: F634 (hex)
Error no: 634
Class: Travel range

F643 Positive travel limit switch detected

The positive travel range limit switch was actuated. The axis was brought to a standstill with error reaction "Velocity command value to zero".

In **P-0-0090, Travel limit parameter** bit 2 has been set as "travel range overrun treated as error" or or a drive control command was started after the end switch had been actuated (e.g., drive-controlled homing).

Cause:

The positive travel range limit switch has been actuated.

Recovery:

1. clear error
2. turn power source back on
3. move axis into the allowed travel range

Note: Command values that go even further outside of the allowed range will be not accepted by the drive. If such are set for the drive then another error will only be generated.

Also see the function description: "Travel range limitations".

F643 - Attributes

H1 Display : F6/43
Mess. no.: F643 (hex)
Error no: 643
Class: Nr. 1

F644 Negative travel limit switch detected

The negative travel limit switch has been encountered. The axis has been brought to a standstill with the "Set velocity command value to zero" error response.

Bit 2 of parameter **P-0-0090, Travel limit parameter** is set for "Exceeding travel range as error", or a drive control command has been started (such as the drive-controlled homing procedure). with the limit switch already actuated.

Cause:

The negative travel limit switch is detected.

Remedy:

1. Reset the error.
2. Turn the power supply on again.
3. Move the axis into the permissible travel range.

Note: The drive will not accept command values which lead out of the permissible travel range. Entering these command values in the drive controller will result in this error.

See also the functional description: "Travel Range Limits".

F644 - Attributes

H1 Display : F6/44
Mess. no.: F644 (hex)
Error no: 644
Class: Travel range

F822 Encoder 1 failure: signal too small

For the high resolution evaluation of a position encoder, the analog signals of the transducer are used. These are monitored for 2 criteria:

1. The pointer length resulting from sine and cosine signal must be **> 1 V**.
2. The max. pointer length from sine and cosine signal must not exceed 11.8 V.

$$Pointerlength = \sqrt{\sin^2 + \cos^2}$$

Fig. 1-7: : Pointer length

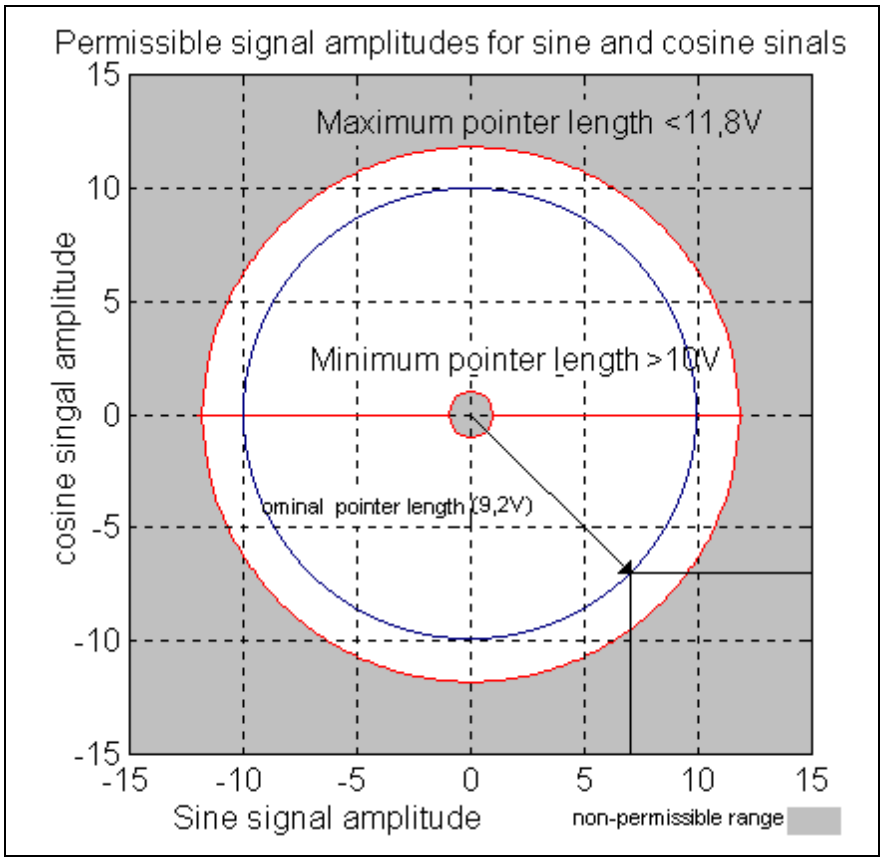


Fig. 1-8: : Correct signal amplitude

Example:

Ucos = -6,5V

Usin = 6,5V

$$Pointerlength = \sqrt{(-6{,}5V)^2 + (6{,}5V)^2} = 9{,}2V$$

Note: The error cannot be cleared in communication phase 4 (operating mode). Before clearing the error, you are obliged to switch to communication phase 2 (parameter mode).

Causes:

1. Feedback Cable defective
2. Transmission of the feedback signals disturbed
3. Feedback defective

Remedies:

1. Check the cable to the measuring system
2. Place the cable apart from the motor power cable. The screen must be connected to the housing of the drive controller.
3. Check the measuring system; replace it, if necessary.

F822 - Attributes

H1 Display :	F8/22
Mess. no.:	F822 (hex)
Error no:	822
Class:	Fatal

F860 Overcurrent: short in power stage

The current in the power transistor bridge has exceeded twice the peak current of the drive. As a result, the drive will immediately switched to a torque-free state. An optional brake is immediately activated.

Cause:

1. Short circuit in the motor cable.
2. Defective power section of the drive controller
3. The current regulator was parameterized with wrong values.

Remedy:

For 1. Check the motor cable for a short.

For 2. Exchange the drive controller.

For 3. The current regulator parameters should not deviate from the default values of the feedback.

F860 - Attributes

H1 Display :	F8/60
Mess. no.:	F860 (hex)
Error no:	860
Class:	Fatal

F870 +24Volt DC error

The drive controller requires a 24-V control voltage. The drive's torque is released immediately when the maximum permissible tolerance of +-20% is exceeded. An optional blocking brake is activated.

Cause:

1. Defective **cable** for the control voltages.
2. 24-V power supply **overload**.
3. Defective power **supply unit**.
4. **Short-circuit** in the emergency stop circuit.

Remedy:

Ref. 1. Check and, if necessary, replace the cable and connections of the control voltages.

Ref. 2. Check the 24-V power at the power supply unit.

Ref. 3. Check the power supply unit.

Ref. 4. Check the emergency stop circuit for a short-circuit.

Note: This error can only be cleared in parametrization mode (phase 2). As a result of this error, the encoder emulation is switched off.

F870 - Attributes

H1 Display : F8/70
Mess. no.: F870 (hex)
Error no: 870
Class: Fatal

F873 Power supply driver stages fault

The voltage supply of the driver stage is monitored, and if the voltage is too low, the drive is turned off.

Cause:

The voltage supply of the driver stage is too low.

Remedy:

Exchange drive controller.

F873 - Attributes

H1 Display : F8/73
Mess. no.: F873 (hex)
Error no: 873
Class: Fatal

F878 Velocity loop error

The velocity loop monitor will appear when the following conditions occur simultaneously:

- The current command value is at the peak current limit.
- The difference between the actual velocity and the command velocity is greater than 2,5 % of the maximum motor velocity.
- actual speed > 1.25 % of maximum speed
- Command and actual acceleration have different qualifying signs.

Cause:

1. Motor cable is connected incorrectly.
2. Defective controller section of the drive
3. Defective feedback
4. Velocity loop paramaterized incorrectly
5. Incorrect commutation offset

Remedy:

For 1. Check the motor cable connection.

For 2. Exchange the drive controller.

For 3. Exchange the motor.

For 4. Check the velocity controller to see whether it is within operational parameters.

For 5. Exchange the motor.

See also the functional description: "Determining the Velocity Controller Setting".

F878 - Attributes

H1 Display : F8/78

Mess. no.: F878 (hex)

Error no: 878

Class: Fatal

F879 Velocity limit S-0-0091 exceeded

In torque control, the actual velocity is monitored. This error is generated if the programmed velocity in the **S-0-0091, Bipolar velocity limit value** parameter is exceeded by the 1.125-fold value or a minimum of 100 rpm (rotary motor) or by 100 mm/min (linear motor).

Cause:

The torque command value was for too long a time greater than the load torque. This causes the actual speed to increase up to the maximum possible motor speed.

Remedy:

Assign the correct torque command value for the required task. Reduce the **S-0-0092, Bipolar torque/force limit value** parameter value.

See also the functional description "Limiting to bipolar velocity limit value".

F879 - Attributes

H1 Display : F8/79

Mess. no.: F879 (hex)

Error no: 879

Class: Fatal

1.5 Warning diagnostic massages

E221 Warning Motor temp. surveillance defective

Temperature monitoring checks to see if the measured motor temperature is within reasonable bounds. If it determines that it is lower than -10°C, then it is assumed the measuring unit is defective. Warning **E221 Warning Motor temp. surveillance defective** will appear for 30 seconds. Afterwards the drive controller will be brought to a standstill according to the selected error response and message **F221 Error Motor temp. surveillance defective** will be generated.

Cause:

1. Motor temperature sensor not connected.
2. Broken cable.
3. Defective sensor.
4. Broken cable in drive controller.

Remedy:

For 1. Connect the sensor to the drive controller and to the motor (see project planning specifications for the motor).

For 2. Exchange the wiring between the drive controller and the motor.

For 3. Exchange the motor.

For 4. Exchange the drive controller.

See also the functional description: "Temperature monitoring".

E221 - Attributes

H1 Display : E2/21

Mess. no.: E221 (hex)

Class: Not fatal

E225 Motor overload

The maximum possible motor current is reduced in order to protect the motor from being destroyed.

If a current flows in the that is greater than 2.2 times the motor current at standstill S-0-0111, the maximum possible motor current **(S-0-0109, Motor peak current)** is reduced. With 4-fold motor current at standstill, the reduction starts after 400 ms. With 5-fold current it starts earlier, and with 3-fold current later.

The **E225 Motor overload** warning is issued when the motor peak current is reduced by the limitation.

The reduction also has an effect on the **P-0-4045, Active permanent current**.

See also the functional description: "Current Limit"

E225 - Attributes

H1 Display : E2/25

Mess. no.: E225 (hex)

Class: Not fatal

E226 Undervoltage in power section

If bit 5 of the **P-0-0118, Power off on error** parameter has been set, an undervoltage condition will be handled as a nonfatal warning. The drive issues this warning if the drive enabling signal is present and the DC bus voltage message disappears.

Cause:

Power supply unit is switched off or mains failure occurs while the drive enabling signal is set.

Remedy:

Switch off the drive enabling signal before you switch off the power supply unit.

E226 - Attributes

H1 Display : E2/26

Mess. no.: E226 (hex)

Class: Not fatal

E247 Interpolation velocity = 0

The drive-internal position command value interpolator is active if

- the "drive-internal interpolation" mode,
- the "relative drive-internal interpolation" mode,
- drive-controlled homing,
- Jog
- drive halt
- Process block mode is active.

The E247 warning is issued if the employed velocity specification is 0. Possible velocity specifications are:

- **S-0-0259, Positioning velocity**
- **S-0-0041, Homing velocity**
- **S-0-0091, Bipolar velocity limit value**
- **P-0-4030, Jog velocity**
- **P-0-4007, Process block velocity**

See also the functional description: "Mode: Drive Internal Interpolation"

E247 - Attributes

H1 Display : E2/47

Mess. no.: E247 (hex)

E248 Interpolation acceleration = 0

Cause:

The drive internal position command interpolator (profile generator) is active. It has been given the acceleration = 0. Without acceleration, it can never reach a given speed.

Operation modes with drive internal position command generation:

1. Drive-internal interpolation
2. Relative drive-internal interpolation
3. Drive-controlled homing

4. Drive Halt
5. Process block mode
6. jog

Remedy:

Input a reasonable value > 0 for the employed acceleration. Possible acceleration specifications, depending from the operation mode, are:

For 1, 2 and 6:	**S-0-0260**, **Positioning acceleration**	**>0**
For 3.:	**S-0-0042, Homing acceleration**	**>0**
For 4.:	**S-0-0138, Bipolar acceleration limit value**	**>0**
For 5.:	**P-0-4008, Process block Acceleration**	**>0**

See also the functional description: "Mode: Drive Internal Interpolation"

E248 - Attributes

H1 Display : E2/48

Mess. no.: E248 (hex)

E249 Positioning velocity >= S-0-0091

Cause:

Operating modes with internal interpolation limit the positioning speed to that set in **S-0-0091, Bipolar velocity limit value.**

This applies to the following modes:

1. Drive Internal Interpolation
2. Relative drive-internal interpolation
3. Positioning Block Mode
4. Jogging

Recovery:

S-0-0259, Positioning Velocity

P-0-4007, Process block velocity

P-0-4030, Jog velocity verringern

Also see functional description: "Operating Mode: Drive Internal Interpolation".

E249 - Attributes

H1 Display : E2/49

Mess. no.: E249 (hex)

Class: Not fatal

E250 Drive overtemp. prewarning

The temperature of the heatsink in the drive controller has reached the maximum permissible temperature. The drive controller follows the command value input for a period of 30 seconds. This makes it possible to bring the axis to a standstill with the control system while keeping true to the process (for example, close the operation, leave the collision area, etc.).

After 30 seconds, the response set in parameter **P-0-0119, Best possible deceleration** will be performed by the drive controller.

Cause:

1. Failure of the drive's internal blower.
2. Failure of the control cabinet's climate control.
3. Incorrect control cabinet dimensioning in regards to heat dissipation.

Remedy:

For 1. If the blower fails, exchange the drive controller.

For 2. Install climatization feature in the cabinet.

For 3. Check the dimensions of the control cabinet.

See also the functional description:"Current Limit"

E250 - Attributes

H1 Display : E2/50

Mess. no.: E250 (hex)

Class: Not fatal

E251 Motor overtemp. prewarning

As soon as the temperature **warning threshold** (145°C) is exceeded, the warning E251 is output, and the drive keeps on following the command value.

This state can last for a long time without powering down. Only when the temperature **error threshold** is exceeded, an immediate powering down will take place.

See also **F219 Motor Overtemperature Shutdown**.

Cause:

The motor is overloaded. The effective torque required from the motor was above the allowable standstill continuous torque for too long.

Remedy:

Check the installation of the motor. For systems which have been in use for a long time, check to see if the drive conditions have changed (in regards to pollution, friction, moving components, etc).

See also the functional description: "Temperature Monitoring".

E251 - Attributes

H1 Display : E2/51

Mess. no.: E251 (hex)

Class: Not fatal

E252 Bleeder overload prewarning

Cause:

The braking resistance (bleeder) in the amplifier is charged with the reflected energy from the motor by about 90%. The bleeder overtemperature warning shows that an overload of the bleeder is expected if the feedback energy increases on and on.

Remedy:

Reduce the acceleration value or velocity. Check the drive installation.

E252 - Attributes

H1 Display : E2/52

Mess. no.: E252 (hex)

Class: Not fatal

E253 Target position out of travel range

In operation modes with drive ontrolled interpolation, the drive checks **before the move** whether the specified **S-0-0258, Target position**, is within the possible travel range of the drive. This range is defined by the parameters **S-0-0049, Positive position limit value** and **S-0-0050, Negative position limit value**. The position limit check is activated in the parameter **S-0-0055, Position polarities** with bit 4.

Cause:

The target position lies beyond the position limits, and the position limit check is activated.

Results:

- This warning message, E253, appears.
- The **drive stops**.
- The drive does not accept the target position or the process block.
- In **S-0-0012, Class 2 diagnostic** warning bit 13 is set.

Remedy:

1. For the Drive controlled interpolation mode, input the **S-0-0258, Target position** only within the position limits.
2. For the Relative drive controlled interpolation mode, do the same, outgoing from the actual position.
3. For the Process block mode, input the **S-0-4006 Process block target position** only within the position limits.
4. For relative process blocks, do the same, outgoing from the actual position.
5. Check the **position limit values**. Moreover, the positive position limit value must be greater than the negative position limit value.
6. If you don’t need the position limit check, de-activate it, e.g. in modulo mode.

See also the functional description: "Mode: Drive Internal Interpolation".

E253 - Attributes

H1 Display : E2/53

Mess. no.: E253 (hex)

Class: Not fatal

E254 Not homed

If absolute positions are selected while in a positioning operation mode, the control drive must be homed to a reference position. If this is not the case, an absolute position cannot be reached. The drive rejects this positioning command and stops. The warning E254 will be given.

Cause:

Absolute positioning was selected without the drive being referenced.

Remedies:

1. Do the homing (referencing) command with the drive or
2. do only relative positioning.

See also the function description "Drive-Controlled Homing".

E254 - Attributes

H1 Display : E2/54

Mess. no.: E254 (hex)

Class: Not fatal

E255 Feedrate-override S-0-0108 = 0

With the parameter **S-0-0108, Feedrate override**, the travel velocity of all in drive-controlled travel commands can be changed proportionally (in %).

If the value of this parameter is 0, the travel velocity is also 0. With velocity = 0, however, the drive can never go anywhere. It cannot follow the applied command values.

Causes:

1. The parameter **S-0-0108, Feedrate override** is **0**.
2. For devices with analog inputs: Feedrate override via analog input is activated, and the voltage there is 0.
3. The **feed potentiometer** of the connected control system is at 0 or is being evaluated incorrectly. Like 4.

Remedies:

For 1.: Set **Feedrate override > 0**, so that the drive moves. Full speed is attained with 100% .

For 2.: Apply a voltage > 0 proportional to the desired speed,
+10V corresponds to 100 % (full) speed.
Alternative: De-activate Feedrate override.

For 3.: Turn the feed potentiometer cautiously, check the analog signal and the evaluation for it.

See also the functional description: "Sequence control "Drive-Controlled Homing"".

E255 - Attributes

H1 Display : E2/55

Mess. no.: E255 (hex)

Class: Not fatal

E256 Torque limit = 0

Cause:

1. For protection against mechanical overload, the maximum torque can be limited by the **S-0-0092, Bipolar Torque Limit** parameter. If the actual value of this parameter is equal to 0, the motor does not develop torque and does not follow the given command values.
2. Torque reduction is set via an analog channel, and the applied voltage amounts to 10 V.

Remedy:

For 1. Set the torque limit to a value greater than 0.

For 2. Establish an analog voltage smaller than 10 V.

See also the functional description:" Current Limit"

E256 - Attributes

H1 Display : E2/56

Mess. no.: E256 (hex)

Class: Not fatal

E257 Continuous current limit active

The drive controller sets the peak current available for 400 ms. Thereafter, the continuous current limit becomes active and dynamically limits the peak current to the continuous current.

Cause:

More continuous torque was required than was available.

Remedy:

1. Check the drive installation.
2. Check the installation of the motor. For systems which have been in use for a long time, check to see whether the drive conditions have changed in regards to
   - pollution
   - friction
   - moved masses

See also the functional description: "Current Limit".

E257 - Attributes

H1 Display : E2/57

Mess. no.: E257 (hex)

Class: Not fatal

E258 Selected process block is not programmed.

Cause:

A positioning block was selected for which there is no set target position or positioning velocity, etc.

Remedy:

Select another positioning block or enter the required data.

See also the functional description: "Positioning Block Mode"

E258 - Attributes

H1 Display : E2/58

Mess. no.: E258 (hex)

Class: Not fatal

E259 Command velocity limit active

In the position control and velocity control operating modes, the effective velocity command value is limited to the value in parameter **S-0-0091, Bipolar velocity limit value**. The warning is given if the resulting velocity command value reaches this limit.

Cause:

Parameter **S-0-0091, Bipolar velocity limit value** was set too low.

Remedy:

In normal operating conditions, set parameter **S-0-0091, Bipolar velocity limit value** to a value 10% greater than the NC effective velocity.

See also the functional description: "Limiting to bipolar velocity limit value".

E259 - Attributes

H1 Display : E2/59

Mess. no.: E259 (hex)

Class: Not fatal

E261 Continuous current limit prewarning

Digital drives are monitored by a continually operating temperature model. If the thermal load reaches 100%, the continuous current limit will be activated shortly thereafter.
Before the torque is reduced, a continuous current limit early warning is given via a switching threshold, which is determined by parameter **P-0-0127, Overload warning**.
To deactivate the warning, enter **P-0-0127** = 100% into the parameter.

Cause:

The drive controller was overloaded.

Remedy:

1. Check the drive layout.
2. Reduce acceleration.
3. Increase the switching threshold in parameter **P-0-0127, Overload warning**
4. With systems which have been used for longer periods of time, check to see if drive controller conditions have changed in regards to:
   - Friction
   - Components which have been moved
   - Feed during processing.

See also the functional description: "Current Limit"

E261 - Attributes

H1 Display : E2/61

Mess. no.: E261 (hex)

Class: Not fatal

E263 Velocity command value > limit S-0-0091

Cause:

The value given to the drive for **S-0-0036, Velocity command value** was greater than permissible.

Remedy:

It is limited to **S-0-0091, Bipolar velocity limit value**.

See also the functional description: "Mode: Velocity Control"

E263 - Attributes

H1 Display : E2/63

Mess. no.: E263 (hex)

Class: Not fatal

E264 Target position out of num. range

Cause:

In modes:

- drive-internal interpolation,
- relative interpolation and
- positioning block mode

the previous target position in the internal position format cannot be illustrated.

Recover:

1. Check the given target position and correct, if necessary.
2. With infinitely turning axes it is necessary that the position data be illustrated in modulo format.
3. The absolute internally illustrable position can be enlarged by enlarging the maximum travel range.

E264 - Attributes

H1 Display : E2/64

Mess. no.: E264 (hex)

Class: Not fatal

E401 Error in the parameter channel

Description:

The fieldbus card communicates during operation with the drive via SIS telegrams as well. A faulty SIS telegram was detected during processing.

Cause:

Error during internal SIS communications between fieldbus card and basic controller card.

E401 - Attributes

H1 Display : E4/01

Mess. no.: E401 (hex)

Class: Interface

E402 Error in the cyclic data channel

Description:

During the execution of a function, the drive has shown not to be ready for operation.

Cause:

This happens when you try to trigger functions on the drive which require e.g. that

- the drive's power is on
- the DRIVECOM state machine is up

E402 - Attributes

H1 Display : E4/02

Mess. no.: E402 (hex)

Class: Interface

E405 No data exchange possible via the field bus

Description:

Data exchange via the fieldbus is not possible.

Cause:

CANOpen:

1. The wrong baudrate is being used to go to the bus.
2. The bus cable is faulty.
3. The bus cable is too long for the baudrate that has been set.

Profibus:

1. The bus cable is faulty.
2. The bus cable is too long for the baudrate that has been set.
3. The master has not yet initialized the slave.

E405 - Attributes

H1 Display : E4/05

Mess. no.: E405 (hex)

Class: Interface

E408 Invalid addressing of MDT-data container A

This warning indicates an error during the **index check in the multiplex channel**. During the cyclical data exchange, the index for the access to the **list S-0-0370**, **Configuration list for MDT data container** is surveyed, whether it points to a non-initialised field in the list. If it does, this warning is generated.

Note: In fieldbus drives, the multiplex channel is used for internal data exchange between controller and communications card.

E408 - Attributes

H1 Display : E4/08

Mess. no.: E408 (hex)

Class: Interface

E409 Invalid addressing of AT-data container A

This warning indicates an error during the **index check in the multiplex channel**. During the cyclical data exchange, the index for the access to the **list S-0-0371**, **Configuration list for the AT data container** is surveyed, whether it points to a non-initialised field in the list. If it does, this warning is generated.

Note: In fieldbus drives, the multiplex channel is used for internal data exchange between controller and communications card.

See also the functional description: "Checking the Indices"

E409 - Attributes

H1 Display : E4/09

Mess. no.: E409 (hex)

Class: Interface

E825 Overvoltage in power stage

The **DC bus voltage** is too high.

Cause:

1. During **braking** (decelerating): the energy reflected from the mechanical system via the motor was so high for a moment that it could not be sufficiently dissipated to heat by the braking resistor (bleeder). The regenerated current could not be drained and therefore charged the DC bus, so that the voltage there has become too high.
2. The **mains voltage** (AC input) is too high.

Result:

In case of overvoltage, the motor is switched to **torque-free** operation. As soon as the DC Bus voltage falls again below the maximum allowable value, the controller will be turned on again.

Remedy:

For 1. Reduce the **acceleration** values.
Check the drive controller layout, if necessary.
Install an auxiliary bleeder, if necessary.

For 2. Check the **mains supply voltage** (AC/3phase).



WARNING

⇒ Danger of high-voltage shock!
Care for protection against accidental touch.

E825 - Attributes

H1 Display :	E8/25
Mess. no.:	E825 (hex)
Class:	Fatal

E826 Undervoltage in power section

If the bit 3 is set in the parameter **P-0-0118, Power off on error**, the undervoltage is treated as "fatal warning“ with shutdown of the drive operation. If the drive enable is on at the same time, and the DC bus voltage indication goes down, the drive displays this warning.

Cause:

Switching off the power supply or mains failure while the drive enable is on.

Remedy:

Switch off the drive enable before switching off the supply unit.

E826 - Attributes

H1 Display :	E8/26
Mess. no.:	E826 (hex)
Class:	Fatal

E829 Positive position limit exceeded

The drive has received a command value which resulted in an axis position outside the positive travel range. The axis has been brought to a standstill by setting the velocity command to zero. A class 1 diagnostic

error is not generated. The drive will automatically follow command values that lead back into the allowed range. "Handle travel range exceeded as warning" is set in bit 2 of parameter **P-0-0090, Command value transmit time (TMTSG)**.

Cause:

S-0-0049, Positive position limit value exceeded.

Remedy:

Enter command values which lead back into the allowed range.

Note: Only such command values will be accepted that lead back into the allowed working range. With other command values, the drive will stop again. - The parameter **S-0-0057, Position window** defines a hysteresis for the travel limits.

See also the functional description: "Travel Range Limits".

E829 - Attributes

H1 Display : E8/29

Mess. no.: E829 (hex)

Class: Fatal

E830 Negative position limit exceeded

The drive has received a command value which resulted in an axis position outside the negative travel range. The axis has been brought to a standstill by setting the velocity command to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values which lead into the allowed range. "Handle travel range exceeded as warning" is set in bit 2 of parameter **P-0-0090, Travel limit parameter**.

Cause:

S-0-0050, Negative travel limit value exceeded.

Remedy:

Enter command values which lead back into the allowed range.

Note: Only such command values will be accepted that lead back into the allowed working range. With other command values, the drive will stop again. - The parameter **S-0-0057, Position window** defines a hysteresis for the travel limits.

See also the functional description: "Travel Range Limits".

E830 - Attributes

H1 Display : E8/30

Mess. no.: E830 (hex)

Class: Fatal

E831 Position limit reached during jog

If the position limit monitor is activated and the drive is “IN REFERENCE", then it will be positioned on the position limit during movement by jogging. If the drive is positioned on the position limit or beyond the position limit, the drive stops and signals "Position limit value reached during jog".

Remedies:

1. Move the motor back within the allowed travel area with the jog function or
2. Turn off the position limit monitor.

See also the functional description: "Operating Mode: Jogging".

E831 - Attributes

H1 Display : E8/31

Mess. no.: E831 (hex)

Class: Fatal

E834 Emergency-Stop

Pressing the emergency stop switch has caused the drive to perform the emergency stop function that had been selected via the **P-0-0119, Best possible deceleration** parameter. There is no error message issued to the controller.

Cause:

The emergency stop switch was pressed.

Remedy:

Eliminate the malfunction that led to the activation of the emergency stop switch. The warning will then disappear.

See also the functional description: "Emergency stop feature".

E834 - Attributes

H1 Display : E8/34

Mess. no.: E834 (hex)

E843 Positive limit switch activated

The drive has received a command value which resulted in an axis position outside the positive travel range. The axis has been brought to a standstill by setting the velocity command to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values that lead back into the allowed range. Bit 2 of **P-0-0090, Travel limit parameter** is set to "Overtravelling is handled as a warning".

Cause:

The positive limit switch has been actuated.

Remedy:

Enter command values that lead back into the allowed range.

See also the functional description: "Travel Zone Limit Switch Monitoring".

E843 - Attributes

H1 Display : E8/43

Mess. no.: E843 (hex)

Class: Fatal

E844 Negative limit switch activated

The drive has received a command value which resulted in an axis position outside the negative travel range. The axis has been brought to a standstill by setting the velocity command to zero. A class 1 diagnostic error is not generated. The drive will automatically follow command values that lead back into the allowed range. Bit 2 of **P-0-0090, Travel limit parameter** is set to "Overtravelling is handled as a warning".

Cause:

The negative limit switch has been actuated.

Remedy:

Enter command values which lead back into the allowed range.

See also the functional description: "Travel Zone Limit Switch Monitoring".

E844 - Attributes

H1 Display :	E8/44
Mess. no.:	E844 (hex)
Class:	Fatal

1.6 Command diagnostic messages

C100 Communication phase 3 transition check

The command **S-0-0127, C1 Communication phase 3 transition check** has been activated.

See also the functional description: "SS-0-0127, C100 Communication phase 3 transition check"

C100 - Attributes

H1 Display : C1

Mess. no.: C100 (hex)

C101 Invalid communication parameter (S-0-0021)

Cause:

Communications parameters which are needed to operate the drive in communication phase 3 are invalid.

Remedy:

A list of the invalid parameters can be seen in parameter **S-0-0021, List of invalid op. data for comm. ph. 2**. The invalid parameters must be rewritten so they are correct.

See also the functional description: "S-0-0127, C1 Communication Phase 3 Transition Check".

C101 - Attributes

H1 Display : C1/01

Mess. no.: C101 (hex)

Class: Command

C102 Limit error communication parameter (S-0-0021)

Cause:

Communications parameters, which are needed to operate the drive in communication phase 3, are outside their limit values.

Remedy:

A list of the invalid parameters can be seen in parameter **S-0-0021, List of invalid op. data for comm. ph. 2**. The invalid parameters must be rewritten with values **between** the respective **min. and the max. value** to be correct.

See also the functional description: "S-0-0127, C100 Communication phase 3 transition check"

C102 - Attributes

H1 Display : C1/02

Mess. no.: C102 (hex)

Class: Command

C104 Config. IDN for MDT not configurable

Cause:

Parameters which are missing in **S-0-0188, List of configurable data in MDT** are kept in **P-0-4081, Process data output description.**

Remedy:

You must either set a priority telegram (Telegram type = 0..6) or provide **P-0-4081, process data output description** with parameters. These parameters are also contained in **S-0-0188, List of configurable data in the MDT**.

See also the functional description: "Configuration of telegram contents"

C104 - Attributes

H1 Display : C1/04

Mess. no.: C104 (hex)

Class: Command

C105 Configurated length > max. length for MDT

Cause:

The length of the configured record in MDT, which is determined by

P-0-4081, Real-time output object structure exceeds the maximum permissible length **S-0-0186, Length of the configurable data record in the MDT.**

Remedy:

The number of configured parameters in MDT (S-0-0024) must be decreased

See also the functional description: "Configuration of telegram contents"

C105 - Attributes

H1 Display : C1/05

Mess. no.: C105 (hex)

Class: Command

C106 Config. IDN for AT not configurable

Cause:

Parameters which are not contained in **S-0-0187, List of configurable data in AT** can be seen in **P-0-4080, Real-time input object structure**

Remedy:

- **P-0-4080, Real-time input object structure** must have parameters that are also in **S-0-0187, Liste der konfigurierbaren Daten im AT**.

See also the functional description: "Configuration of telegram contents"

C106 - Attributes

H1 Display : C1/06

Mess. no.: C106 (hex)

Class: Command

C107 Configurated length > max. length for AT

Cause:

The length of the configured data record in the AT, that is defined via **P-0-4080**, **Real-time input object structure** exceeds the v maximum permissible **S-0-0185, Length of the configurable data record in the AT**.

Remedy:

number of configurated parameters in the AT (**P-0-4080**) must be decreased

See also the functional description: "Configuration of telegram contents"

C107 - Attributes

H1 Display : C1/07

Mess. no.: C107 (hex)

Class: Command

C112 TNcyc (S-0-0001) or TScyc (S-0-0002) error

Cause:

Only multiples of 1ms are permitted as valid values for **S-0-0001, NC Cycle time (TNcyc)** and **S-0-0002, SERCOS Cycle time (Tscyc)**. Here, this is not the case.

Remedy:

S-0-0001, NC Cycle time (TNcyc) and **S-0-0002, SERCOS Cycle time (Tscyc)** must be corrected. These parameters are determined by the manufacturer of the control system and are specified by the SERCOS interface.

C112 - Attributes

H1 Display : C1/12

Mess. no.: C112 (hex)

Class: Command

C113 Relation TNcyc (S-0-0001) to TScyc (S-0-0002) error

Cause:

The value of **S-0-0001, NC Cycle time (TNcyc)** can only be equal to or be a multiple of **S-0-0002, SERCOS Cycle time (Tscyc)**. Here this is not the case.

Remedy:

S-0-0001, NC Cycle time (Tncyc) and **S-0-0002, SERCOS Cycle time (Tscyc)** must be corrected. These parameters are determined by the manufacturer of the control system and are specified by the SERCOS interface.

C113 - Attributes

H1 Display : C1/13

Mess. no.: C113 (hex)

Class: Command

C114 T4 > TScyc (S-0-0002) - T4min (S-0-0005)

Cause:

The maximum permissible value for **S-0-0007, Feedback acquisition starting time (T4)** is

S-0-0002, SERCOS Cycle time (Tscyc) - S-0-0005, Minimum feedback acquisition time(T4min)

The value for **S-0-0007, Feedback acquisition starting time (T4)** is incorrect.

Remedy:

Correct S-0-0007, Feedback acquisition starting time (T4). These parameters are determined by the manufacturer of the control system and are specified by the SERCOS interface.

C114 - Attributes

H1 Display : C1/14

Mess. no.: C114 (hex)

Class: Command

C118 Order of MDT configuration wrong

The chronological order of processing the cyclical MDT data in the drive is the same order in which the configurated ident numbers (IDN) are placed in the parameter **S-0-0024, Config. list of the master-data-telegram**.

If both parameters **S-0-0360, MDT Data container A** and **S-0-0368, Addressing for data container A** as well are configured in the MDT, then the processing of the MDT data container is only correct if the addressing has been processed before. To maintain the correct order for the configuration of the MDT, the drive checks in the command S-0-0127, C100 Communication phase 3 transition check, whether the **IDN S-0-0368** is configured **before S-0-0360**.

If this is not the case, the drive generates the command error **C118 Order of MDT configuration wrong**.

C118 - Attributes

H1 Display : C1/18

Mess. no.: C118 (hex)

Class: Command

C200 Communication phase 4 transition check

Meaning:

The command **S-0-0128, C200 Communication phase 4 transition check** has been activated.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C200 - Attributes

H1 Display : C2

Mess. no.: C200 (hex)

C201 Invalid parameter(s) (->S-0-0022)

Cause:

Parameters which will be necessary to operate the drive in communications phase 4 are invalid. The invalid parameters can be seen in **S-0-0022, IDN list of invalid op. data for comm. ph. 3**.

Remedy:

The parameters of **S-0-0022, IDN list of invalid op. data for comm. ph. 3** must be rewritten so they are correct.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C201 - Attributes

H1 Display : C2/01

Mess. no.: C201 (hex)

Class: Command

C202 Parameter limit error (->S-0-0022)

Cause:

Parameters which are necessary to operate the drive in communications phase 4 are outside of their minimum or maximum input values, or the entered value can't be processed (for bit bars). The incorrect parameters are listed in **S-0-0022, IDN list of invalid op. data for comm. ph. 3**.

Remedy:

The parameters of **S-0-0022, IDN list of invalid op. data for comm. ph. 3** must be rewritten with correct values.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C202 - Attributes

H1 Display : C2/02

Mess. no.: C202 (hex)

Class: Command

C203 Parameter calculation error (->S-0-0022)

Cause:

Parameters that are required for phase-4 operation (operating mode) cannot be processed in that way. The incorrect parameters are listed in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph. 3**.

Remedy:

Write correct values to the parameters in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph. 3**.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C203 - Attributes

H1 Display : C2/03

Mess. no.: C203 (hex)

Class: Command

C204 Motor type P-0-4014 incorrect

An MHD-, MKD or MKE motor (value 1 or 5) is entered into parameter **P-0-4014, Motor type**. The appropriate abbreviation "MHD", "MKD", or "MKE" however, was not found in parameter **S-7-0141, Motor type** in the motor feedback data memory.

Cause:

1. Incorrect parameter set for type of motor.
2. The motor feedback memory cannot be read.
3 motor feedback - not connected

Remedy:

For 1. Enter the type of motor used in parameter **P-0-4014, Motor type**

For 2. Check feedback connection.
If feedback is defective, exchange motor.

See also the functional description: "Automatic setting of the motor type for motors with feedback memory".

C204 - Attributes

H1 Display : C2/04

Mess. no.: C204 (hex)

Class: Command

C210 Feedback 2 required (->S-0-0022)

Cause:

Values that require an optional encoder have been entered in **S-0-0147, Homing parameter** or in the **S-0-0032...35, Mode of Operation** parameters. However, 0 (not available) has been entered in the **P-0-0075, Interface Feedback 2, optional** parameter.

The ident number of the parameter that requires the optional encoder is entered in **S-0-0022, IDN List of Invalid Op. Data for Comm. Ph. 3**.

Remedy:

Modify **S-0-0147, Homing parameter** or the **S-0-0032...35, Mode of Operation** parameters to utilization of the motor encoder instead of optional encoder.

Set **P-0-0075, Interface Feedback 2, optional** to a value different from 0 to activate the optional measuring system.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C210 - Attributes

H1 Display : C2/10

Mess. no.: C210 (hex)

Class: Command

C211 Invalid feedback data (->S-0-0022)

Invalid data has been encountered when the parameters stored in the motor feedback were read, or an error has occurred when the data was read.

Causes:

1. Motor feedback cable not connected or defective
2. Motor feedback defective
3. Drive controller defective

Remedy:

Ref. 1. Check motor feedback cable; connect both sides

Ref. 2. Replace motor

Ref. 3. Replace amplifier

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C211 - Attributes

H1 Display : C2/11

Mess. no.: C211 (hex)

Class: Command

C212 Invalid amplifier data (->S-0-0022)

During drive initialization, the operating software fetches data from an EEPROM in the drive controller. This error message is generated after that access has failed.

Causes:

Defective hardware in the drive controller.

Remedy:

Replace drive controller.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C212 - Attributes

H1 Display : C2/12

Mess. no.: C212 (hex)

Class: Command

C213 Position data scaling error

Cause:

The scaling parameters for position data permit the position data display format to be selected. The drive-internal position data format depends on the employed motor encoder and the encoder resolution. The factor used for converting the position data from the drive-internal format into the display format or vice versa is outside the processable range, because either

- linear motor and rotary position scaling with motor reference, or
- rotary motor and linear position scaling with motor reference, or
- linear motor with modulo scaling has been selected; or
- the determined factor used for converting the position data from the display format to the internal format, and vice versa, cannot be represented.

Remedy:

Checking and correcting the relevant parameters, such as

- **S-0-0076, Position data scaling type**
- **S-0-0077, Linear position data scaling factor**
- **S-0-0078, Linear position data scaling exponent**
- **S-0-0079, Rotational position resolution**
- **S-0-0116, Resolution of motor feedback**
- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**
- **S-0-0123, Feed constant**
- **P-0-0074, Interface feedback 1**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C213 - Attributes

H1 Display : C2/13

Mess. no.: C213 (hex)

Class: Command

C214 Velocity data scaling error

Cause:

The scaling parameters for velocity data permit the velocity data display format to be selected. The drive-internal velocity data format depends on the employed motor encoder and the encoder resolution. The factor used for converting the velocity data from the drive-internal format into the display format or vice versa is outside the processable range.

Remedy:

Checking and correcting the relevant parameters, such as

- **S-0-0044, Velocity data scaling type**
- **S-0-0045, Velocity data scaling factor**
- **S-0-0046, Velocity data scaling exponent**
- **S-0-0116, Resolution of motor feedback**
- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**
- **S-0-0123, Feed constant**
- **P-0-0074, Interface feedback 1**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C214 - Attributes

H1 Display : C2/14

Mess. no.: C214 (hex)

Class: Command

C215 Acceleration data scaling error

Cause:

The display format of the acceleration data can be set using acceleration scaling parameters. The drive-controlled format of the acceleration data is dependent on what motor encoder and encoder resolution are used. The factor for converting acceleration data from internal drive format to display format (or vice-versa) is outside the workable range.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0160, Acceleration data scaling type**
- **S-0-0161, Acceleration data scaling factor**
- **S-0-0162, Acceleration data scaling exponent**
- **S-0-0116, Resolution of motor feedback**
- **S-0-0121, Input revolutions of load gear**
- **S-0-0122, Output revolutions of load gear**
- **S-0-0123, Feed constant**
- **P-0-0074, Interface feedback 1**
- **S-0-0277, Position feedback 1 type parameter**

See also the functional description "S-0-0128, C200 Communication phase 4 transition check"

C215 - Attributes

H1 Display : C2/15

Mess. no.: C215 (hex)

Class: Command

C216 Torque/force data scaling error

Cause:

The display format of the torque/force data can be set using torque/force scaling parameters. The factor for converting torque data from drive-controlled format to display format (or vice-versa) is outside the workable area.

Remedy:

Check and set the relevant parameters correctly as follows:

- **S-0-0086, Torque/force data scaling type**
- **S-0-0093, Torque/force data scaling factor**
- **S-0-0094, Torque/force data scaling exponent**
- **S-0-0110, Amplifier peak current**
- **S-0-0111, Motor current at standstill**

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C216 - Attributes

H1 Display : C2/16

Mess. no.: C216 (hex)

Class: Command

C217 Feedback1 data reading error

All MKD und MHD motors have a data memory in the feedback unit. From there, settings for the encoder are read.

Cause:

During reading of the values from the feedback, an error has occurred.

Remedy:

Check feedback cable.

Change motor.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C217 - Attributes

H1 Display : C2/17

Mess. no.: C217 (hex)

Class: Command

C218 Feedback 2 data reading error

The initializatin of the measuring systems is done in the command **S-0-0128, C200 Communication phase 4 transition check**. If the measuring system to initialize has an intrinsic data memory, this memory is read.

The error C218 Feedback 2 data reading error is generated, if an additional optional encoder (encoder 2) is present and being evaluated (**P-0-0075 Feedback 2 type** other than 0) and if an error is discovered while reading the data.

Measuring systems with intrinsic data memory are :

- DSF/HSF/LSF and resolver, as well as
- measuring systems with Endat interface (from Heidenhain)

Cause:

1. Defective measurement system cable
2. Defective measurement system

Remedy:

For 1. Check the measurement system cable.

For 2. Exchange the measurement system.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C218 - Attributes

H1 Display : C2/18

Mess. no.: C218 (hex)

Class: Command

C220 Feedback 1 initializing error

A number of tests are performed when the motor encoder is initialized. An error was detected during this process. This error may be:

- Error while reading the angle rectification data
- Error while copying the angle rectification data
- Interruption of communication with the encoder

- Assembly error with the position of an initialization track
- Error while reading the analog signal of an initialization track
- Error in the pointer length of the analog signal of an initialization track
- Invalid offset between the high and low resolution track
- Error in the measuring system micro-controller

Cause:

1. Defective motor feedback **cable**
2. Defective motor **feedback**
3. Defective measurement system **interface**

Remedy:

For 1. Check the motor feedback cable.

For 2. Exchange the motor.

For 3. Exchange the measuring system interface, if it is a module, or the complete drive controller.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C220 - Attributes

H1 Display : C2/20

Mess. no.: C220 (hex)

Class: Command

C221 Feedback 2 initializing error

Several checks are performed during the initialization of an optional encoder. An error has been detected during this process. This error may be:

- Error while reading the angle rectification data
- Error while copying the angle rectification data
- Interruption of communication with the encoder
- Assembly error with the position of an initialization track
- Error while reading the analog signal of an initialization track
- Error in the pointer length of the analog signal of an initialization track
- Invalid offset between the high and low resolution track
- Error in the measuring system micro-controller
- With DAG 1.2: external 24V set for SSI interface

Cause:

1. External encoder cable defective.
2. Defective feedback.
3. Defective measurement system interface.

Remedy:

For 1. Check the optional feedback cable.

For 2. Exchange feedback.

For 3. Exchange the measuring system interface (module).

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C221 - Attributes

H1 Display : C2/21

Mess. no.: C221 (hex)

Class: Command

C223 Input value for max. range too high

Cause:

An internal position resolution has been selected via the **S-0-0278, Maximum travel range** parameter that no longer guarantees a correct commutation of the motor.

Remedy:

Select a smaller value for the **S-0-0278, Maximum travel range** parameter.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C223 - Attributes

H1 Display : C2/23

Mess. no.: C223 (hex)

Class: Command

C227 Modulo range error

Cause:

The marginal conditions for modulo processing were not maintained.

See functional description: "Modulo processing marginal conditions".

C227 - Attributes

H1 Display : C2/27

Mess. no.: C227 (hex)

Class: Command

C234 Encoder combination not possible

Cause:

The encoder interface that has been selected in the **P-0-0075, Interface Feedback 2, optional** parameter cannot be supported by the drive; it has already been allocated to the motor encoder.

Remedy:

Select another **optional** encoder.

See also the functional description: "Determining the encoder interface of the optional encoder"

C234 - Attributes

H1 Display : C2/34

Mess. no.: C234 (hex)

Class: Command

C235 Load-side motor encoder with inductance motor only

Cause:

The functionality of the optional encoder can be defined in the **P-0-0185, Function of opt. encoder** parameter. If 'load-side motor encoder' has been selected as the function of the optional encoder, that function will only be supported for asynchronous motors.

Remedy:

Set the **P-0-4014, Motor type** parameter according to the employed motor type.

Check the **P-0-0185, Function of opt. encoder** parameter.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C235 - Attributes

H1 Display : C2/35

Mess. no.: C235 (hex)

Class: Command

C236 Feedback 1 required (P-0-0074)

Cause:

A motor encoder is not required (P-0-0074 = 0) if a load-sided motor encoder has been selected via the **P-0-0185, Function of opt. encoder** parameter. However, **S-0-0147, Homing parameter** or the **S-0-0032...35, Mode of Operation** parameters contain values that require a motor encoder.

Remedy:

Change **S-0-0147, Homing parameter** or the **S-0-0032...35, Mode of Operation** parameters such that they are suitable for using an optional encoder.

Enter a value ≠ 0 in the **P-0-0074, Interface feedback 1** parameter to activate the motor encoder.

See also the functional description "S-0-0128, C200 Communication phase 4 transition check".

C236 - Attributes

H1 Display : C2/36

Mess. no.: C236 (hex)

Class: Command

C300 Command Set absolute measuring

Command **P-0-0012, C300 Command 'Set absolute measurement'** was activated by the control system in use.

See also the functional description: "Set absolute measuring"

C300 - Attributes

H1 Display : C3

Mess. no.: C300 (hex)

C302 Absolute measuring system not installed

Command **P-0-0012, C300 Command 'Set absolute measurement'** was started without an absolute measuring system being present.

The command cannot be processed because no absolute measuring system is available.

Cause:

1. The command should not have been activated.
2. The contacted motor or the external measurement system was not executed as an absolute encoder.

Remedy:

For 1. Stop execution of the command.

For 2. Equip the motor or external measurement system with an absolute encoder function.

See also the functional description: "Set Absolute Measuring"

C302 - Attributes

H1 Display : C3/02

Mess. no.: C302 (hex)

Class: Command

C400 Switching to parameter mode

The command for transition into parameter mode. Before editing parameters that can be edited only in parameter mode, this command must be processed.

See also the functional description: "Parametrization Mode - Operating Mode"

C400 - Attributes

H1 Display : C4

Mess. no.: C400 (hex)

C401 Drive active, switching not allowed

Cause:

The command **C400 Command: Switch to parameter mode** has been started, although the drive enable is on.

Remedy:

End the command and turn off the drive enable, then the command can be started again.

See also the functional description: "Parametrization Mode - Operating Mode"

C401 - Attributes

H1 Display : C4/01

Mess. no.: C401 (hex)

Class: Command

C402 Only allowed without master

Cause:

The command **P-0-4023, C400 Communication phase 2 transition** was started even though the command communiations interface (SERCOS or fieldbus) is active (P-0-4086 = 00b).

The command can only be executed if the command communications interface (SERCOS or fieldbus) is **inactive** (P-0-4086 = xx1b).

Recovery:

Bring status machine of fieldbus back to basic status prior to command start. (The bus connector can be pulled to do so!)

C402 - Attributes

H1 Display : C4/02

Mess. no.: C402 (hex)

Class: Command

C500 Reset class 1 diagnostic, error reset

The command for clearing errors, **S-0-0099, C500 Reset class 1 diagnostic** was activated by the control system in use. All drive internal errors are cleared. But before, the cause of the error must have been cleared.

See also the functional description: "Clearing errors"

C500 - Attributes

H1 Display : C5

Mess. no.: C500 (hex)

C600 Drive controlled homing procedure command

Command **S-0-0148, C600 Drive controlled homing procedure command** has been activated by the control system in use.

See also the functional description: "Drive-controlled homing"

C600 - Attributes

H1 Display : C6

Mess. no.: C600 (hex)

C601 Homing only possible with drive enable

Cause:

The controller enabling signal was not active when the program was started. This is not permitted.

Remedy:

1. Switch on the controller enable signal.
2. Start the command again.

See also the functional description: "Functions of the Control During Drive-Controlled Homing"

C601 - Attributes

H1 Display : C6/01

Mess. no.: C601 (hex)

Class: Command

C602 Distance home switch - reference mark erroneous

Cause:

The evaluation of the homing switch has been activated. The distance between the positive homing switch edge and the reference mark that shall be interpreted is outside the valid range.

Remedy:

Read the value from the **S-0-0298, Reference cam shift by ...** parameter and enter it in the **S-0-0299, Home switch offset** parameter.

See also the functional description: "Connection of the Home switch"

C602 - Attributes

H1 Display : C6/02

Mess. no.: C602 (hex)

Class: Command

C604 Homing of absolute encoder not possible

Cause:

If, with absolute encoder, the homing command was called without having done the command **P-0-0012, Set absolute measuring** before, the homing command is cancelled with this error.

If the encoder had been referenced with the "**Set absolute measuring**", then the homing command would give you a possibility to trigger a positioning move to the reference point.

Remedy:

Home the absolute encoder with the command "**Set absolute measuring**".

See also the functional description: "Possible Error Messages During Drive-Controlled Homing".

C604 - Attributes

H1 Display : C6/04

Mess. no.: C604 (hex)

Class: Command

C700 Basic load

With motors of the MHD, MKD and MKE series, the controller parameters for the connected motor that are stored in the controller are set to their default values by activating the controller parameters that are stored in the motor feedback. The drive controller issues the C7 message to indicate that the **C700 Basic load** command has been activated via the command parameter **S-0-0262, C700 Command basic load**.

Cause:

The command **C700 Basic load** has been activated.

See also the functional description "Load default"

C700 - Attributes

H1 Display : C7

Mess. no.: C700 (hex)

C702 Default parameters not available

With motors of the MHD, MKD and MKE series, adapting the control loops to the connected digital drive is done by activating the speed controller parameters that are stored in the motor feedback. The drive controller employs the **C702 Default parameters not available** message to signal that the **S-0-0262, C700 Command basic load** command has been activated, but that there is no data memory at the connected motor.

Remedy:

Order the parameter sheet of the employed motor from the INDRAMAT Service, and enter the parameters.

See also the functional description: "Error Conditions of the Load Default Settings Procedure"

C702 - Attributes

H1 Display : C7/02

Mess. no.: C702 (hex)

Class: Command

C703 Default parameters invalid

Cause:

The default parameters are read from the motor feedback data memory. At least one of these parameters is invalid.

Remedy:

Check the connection to the motor feedback. Exchange the motor if necessary.

See also the functional description: "Error Conditions of the Load Default Settings Procedure"

C703 - Attributes

H1 Display : C7/03

Mess. no.: C703 (hex)

Class: Command

C704 Parameters not copyable

Cause:

The default parameters in use are not compatible with this software version.

Remedy:

Please contact Indramat. Explain, which software version, which device and which motor type you have.

See also the functional description: "Error Conditions of the Load Default Settings Procedure"

C704 - Attributes

H1 Display : C7/04

Mess. no.: C704 (hex)

Class: Command

C800 Default parameter load

How to start the command:

This command can be started in 2 ways:

1. When "PL" is displayed on the drive controller (appears after a change in firmware version), by pressing the S1 button beneath the display.
2. By starting the **P-0-4094, C8 Default parameter load**

What the command does:

All the **parameters are** cleared and preset with their default (initial) value. Process blocks and control loop settings are **overwritten**, too.

Default parameters:

Default values are stored in the drive for all parameters which figure in the list **S-0-0192, IDN-list of backup operation data**. They define a **basic state** of the drive that permits the drive to be switched "ready for operation" (display "bb"). Mechanical components like gear and load as well as the control loop settings therefore are not taken into consideration.

See also the functional description: "Basic parameter block".

C800 - Attributes

H1 Display : C8

Mess. no.: C800 (hex)

C801 Parameter default value erroneous (-> S-0-0021)

Cause:

During the execution of **P-0-4094, C800 Command Base-parameter load,** a default value that has been stored in the drive was recognized as incorrect. The related parameter is entered in the **S-0-0021, IDN-list of invalid op. data for comm. Ph. 2**.

See also the functional description: "Basic parameter block"

C801 - Attributes

H1 Display : C8/01

Mess. no.: C801 (hex)

Class: Command

C802 Locked with password

The parameter **S-0-0267, Password** offers the possibility to set a **write protection** for the drive parameters. The diagnostic message **C705 Locked with password** indicates, that the command **P-0-4094, C800 Command Base-parameter load** has been started, although the drive parameters are protected with the customer password.

See also the functional description: "Basic parameter block"

C802 - Attributes

H1 Display : C8/02

Mess. no.: C802 (hex)

Class: Command

D300 Command adjust commutation

A correctly adjusted commutation offset is mandatory for the operation of synchronous motors. The "D3“ message indicates that the command has been activated, that is used for determining the commutation offset.

Cause:

The commutation setting command has been activated.

See also the functional description: "Determining the commutation offset"

D300 - Attributes

H1 Display : d3

Mess. no.: D300 (hex)

D301 Drive not ready for commutation command

Cause with linear motor:

There must not be a controller enable signal when the command is started. However, it must be in communication phase 4 ("bb“ or "Ab“ displayed).

Cause with rotary synchronous motor:

The drive must be in torque control mode when the "D3“ command is started.

This error message is generated if those conditions are not satisfied.

Remedial action with linear motor:

Depending on the motor type, switch off the controller enable signal and start the command again.

Remedial action with rotary synchronous motor:

Activate torque control and start the command again.

See also the functional description: "Determining the commutation offset in rotary synchronous motors (MBS)"

D301 - Attributes

H1 Display : d3/01

Mess. no.: D301 (hex)

Class: Command

D302 Torque/Force too small to move

The command **D3 Command adjust commutation** has been started. To perform this, the motor must move. But it doesn’t move.

Cause:

1. The torque is too small to overcome mechanical resistances (friction or weight).
2. The motor is **blocked** mechanically.
3. Motor movement and encoder rotation direction are contradictory to each other.

Remedy:

1. Increase the **S-0-0092, Torque/Force limit** bipolar so that the motor overcomes the mechanical resistances and can turn. Check also P-0-0109, Torque/Force peak limit; this parameter value should be at least as great as S-0-0092.

2. Clear the jamming. Check also the brake.
3. At the motor connection, switch 2 phases or turn rotational direction of encoder (Parameter S-0-0277, position encoder type parameter 1).

Note: For devices with analog inputs, the torque can be limited via an **analog torque reduction**.

See also the functional description: "Determining the commutation offset"

D302 - Attributes

H1 Display : d3/02

Mess. no.: D302 (hex)

Class: Command

D500 Command Get mark position

The **P-0-0014, D500 Command determine marker position** command can be used for checking the correct acquisition and position of the reference marker of an incremental measuring system. The "d5“ display shows that the command has been activated.

Cause:

The **Determine marker position** command has been activated.

See also the functional description: "Functional principle of command detect marker position"

D500 - Attributes

H1 Display : d5

Mess. no.: D500 (hex)

D501 Incremental encoder required

Cause:

The command has been started for a measuring system that does not possess real reference markers. These include measuring systems such as DSF, EnDat, SSI or resolver measuring systems.

Remedy:

Check whether the correct encoder has been selected in **S-0-0147, Homing parameter**.

Employ an encoder system with real reference markers.

See also the functional description: "Functional principle of command detect marker position"

D501 - Attributes

H1 Display : d5/01

Mess. no.: D501 (hex)

Class: Command

D600 Cancel reference point procedure command

Meaning:

The reference of the encoder that has been selected via **S-0-0147, Homing parameter** is canceled.

Cause:

The **D600 Cancel reference point procedure command** has been activated.

See also the functional description: "Drive-Controlled Homing"

D600 - Attributes

H1 Display : d6

Mess. no.: D600 (hex)

D700 Parking axis command

The command permits one or more drives of a drive package to be stopped without error messages being issued to the controller and/or the power supply module. The remaining drives of the package can be handled without any restrictions.

Cause:

The **S-0-0139, D700 Command parking axis** command has been activated.

See also the functional description: "Command Parking Axis"

D700 - Attributes

H1 Display : PA

Mess. no.: D700 (hex)

D801 Measuring wheel operation not possible

Definition:

The measuring wheel mode command cannot be conducted.

Cause:

- Optional encoder not parametrized (P-0-0075)
- Use of optional encoders as measuring wheel encoder has not been parametrized (P-0-0185 =3).

D801 - Attributes

H1 Display : d8/01

Mess. no.: D801 (hex)

Class: Command

D900 Command automatic loop tuning

Description:

The start of this command means that an automatic control loop setting is executed in the drive if the drive is in the loop at command start, i.e., the drive enable signal is applied.

See also Function description "Automatic Control Loop Settings"



WARNING

⇒ The start of this command can trigger a movement if drive enable and drive start are at the drive.

⇒ The drive conducts autonomous movements within the range defined by both limits.

⇒ The E-stop sequence function and the travel range limit switch must be guaranteed and checked.

See also Function description:
"Safety Instructions"

⇒ During command D9, the drive autonomously conducts motions, i.e., without external command value.

D900 - Attributes

H1 Display : d9

Mess. no.: D900 (hex)

D901 Start requires drive enable

Description:

To ensure that the drive is in the loop when starting the command **P-0-0162, D9 automatic control loop setting,** such is queried at command start.

Cause:

Drive enable not set at command start (NO-RF)

Remedy:

Set drive enable and restart command.

See also the functional description: "Automatic Control Loop Settings"

D901 - Attributes

H1 Display : d9/01

Mess. no.: D901 (hex)

Class: Command

D902 Motor feedback data not valid

Description:

At the start of the automatic control loop setting (**P-0-0162),** the motor parameters

- torque constant
- rated current of unit are read out of the feedback.

Cause:

- One of the above feedback data has a value smaller than or equal to zero (<=0). This means that the controller parameter is incorrectly calculated.
- Motor without feedback data storage.

Remedy:

If known, write the correct values back into the parameter or contact Indramat Customer Service to obtain the feedback data valid for your motor.

In the worst case, it may be necessary to replace the motor.

See also the functional description:"Automatic control loop setting**"**

D902 - Attributes

H1 Display : d9/02

Mess. no.: D902 (hex)

Class: Command

D903 Inertia detection failed

Description:

At the start of the automatic control loop setting, the load moment of inertia is determined with an "oscillation attempt".

This means that the speed change and the motor current must exceed a minimum value during acceleration or deceleration to guarantee a sensible and sufficiently precise calculation of the moment of inertia.

Cause:

- drive acceleration too low
- number of measured value too small for automatic control loop setting
- motor speed too low
- load moment of inertia too big

Remedy:

- increase bipolar torque/force value **S-0-0092**
- increase pos. accel S-0-0260
- increase pos. speed S-0-0259
- increase feedrate override S-0-0108

See also Function description: "Prerequisites for Starting Automatic Control Loop Settings"

D903 - Attributes

H1 Display : d9/03

Mess. no.: D903 (hex)

Class: Command

D904 Gain adjustment failed

Description:

In exceptional cases, difficulties in the automatic control loop setting may arise. This means that an automatic setting is not possible. Standard or default values must therefore be loaded into the drive.

Cause:

- oscillating mechanical systems (resonance)
- high level of interference in the encoder signal

Remedy:

Satisfactory results can sometimes be achieved by starting the command **P-0-0162, D9 automatic control loop setting** with a large **P-0-0163, damping factor for automatic control loop setting**, i.e., low dynamics.

This value can be reduced until the control loop behaves as needed.

If even then control loop settings remain unsuccessful, then the setting must be manual.

See also the functional description:"Automatic control loop setting**"**

D904 - Attributes

H1 Display : d9/04

Mess. no.: D904 (hex)

Class: Command

D905 Travel range invalid, P-0-0166 & P-0-0167

Description:

Before starting an automatic control loop setting, both travel range limits, i.e., upper and lower, must be defined.

When starting command **P-0-0162, D9 automatic control loop setting** the number values are automatically checked for validity. It is checked if the traversing path is large enough and if sensible values have been entered.

cause:

- **P-0-0167, upper traversing range** smaller than **P-0-0166, lower traversing range**
- Maximum traversing path (**P-0-0169, Travel distance for autom. control loop adjust**) is less than 6 motor rotations and thus too small to start the automatic control loop setting.

Remedy:

- clear command error by ending the command
- a) input new limits whereby:upper > lower limits
  b) redefine limits to define a larger traversing range
- restart command with sensible traversing range

See also Function description: "Prerequisites for Starting Automatic Control Loop Settings"

D905 - Attributes

H1 Display : d9/05

Mess. no.: D905 (hex)

Class: Command

D906 Travel range exceeded

Description:

During automatic control loop setting, there is a constant monitoring of the valid traversing range **P-0-0166** and **P-0-0167**.

Cause:

If only one of these limits is exceeded, then command error **D906** is generated and the drive brought to standstill speed controlled.

Possible causes:

- actual position outside of defined traversing range
- limits redefined after command start

Remedy:

- clear command error and end command
- redefine limits so that the actual position is within defined traversing range
- retart command using sensible traversing range

See also Function description: "Prerequisites for Starting Automatic Control Loop Settings"

D906 - Attributes

H1 Display : d9/06

Mess. no.: D906 (hex)

Class: Command

1.7 Status diagnostic messages

A002 Communication phase 2

For field bus and SERCOS devices, the control demands via the master communication "communication phase 2", or the drive has been switched to phase 2 by the command **P-0-4023, C400 Communication phase 2 transition**. Therefore, the drive is in the "parameter mode". In this mode, many parameters are editable, which can no more be edited in "communication phase 4" ("operation mode").

In this phase, usually

- for field bus and SERCOS devices, the communication parameters are transferred from the control to the drive and
- the functions Load and Save parameters ("file services“) are performed when needed.

Before switching to communication phase 3 is possible, the command **S-0-0127, C100 Communication phase 3 transition check** must be done. In this command, the drive checks e.g. the validity of the parameters needed for the communication phase 3.

After successful execution of the command, the control switches the drive to comm. phase 3 (with field bus and SERCOS devices), or the drive switches by itself to phase 3 at the end of the command.

See also the functional description: "Parametrization Mode - Operating Mode".

A002 - Attributes

H1 Display : P2

Mess. no.: A002 (hex)

A003 Communication phase 3

For field bus and SERCOS devices, the control demands via the master communication "communication phase 3", or the drive has been switched to phase 3 by the command **S-0-0127, C100 Communication phase 3 transition check**. The drive is in the "restricted parameter mode". In this mode, still many parameters are editable too, which can no more be edited in "communication phase 4" ("operation mode").

Before switching to communication phase 4 is possible, the command **S-0-0128, C200 Communication phase 4 transition check** must be done. In this command, the drive checks e.g. the validity of the parameters needed for the communication phase 4 ("operation mode").

After successful execution of the command, the control switches the drive to comm. phase 4 (with field bus and SERCOS devices), or the drive switches by itself to phase 4 at the end of the command.

See also the functional description: "Parametrization Mode - Operating Mode".

A003 - Attributes

H1 Display : P3

Mess. no.: A003 (hex)

A010 Drive HALT

Note: This diagnosis appears with fieldbus drives is the status machine is in "ready to operate" mode.

Description:

The Drive-Halt feature is for decelerating the axis to standstill at defined **acceleration and** defined **jerk**.

In **process block mode**, the acceleration and the jerk value of the previous process block are active.

In **Jog mode** and in stepper position mode,
for **acceleration, S-0-0260**, **Positioning Acceleration** is taken, and
for jerk, **S-0-0193**, **Positioning Jerk** is taken.

In **Velocity control** and in Torque control mode, the drive is decelerated to standstill by setting the velocity command to 0 and with the max. torque.

See also the functional description: "The Functional Principle of Drive Halt".

A010 - Attributes

H1 Display : AH

Mess. no.: A010 (hex)

A012 Control and power sections ready for operation

The drive is supplied with **control voltage**, and the power is **switched on**. The drive is **ready** to deliver **power.**

A012 - Attributes

H1 Display : Ab

Mess. no.: A012 (hex)

A013 Ready for power on

The drive is supplied with a **control voltage**, and there are **no errors** in the drive controller.

The drive is **ready** to be turned **on with power**.

See also the functional description: "Parametrization Mode - Operating Mode".

A013 - Attributes

H1 Display : bb

Mess. no.: A013 (hex)

A100 Drive in TORQUE control

The drive is in the torque control operating mode. It follows the torque command value sequence which was set by the control system.

See also the functional description: "Operating Mode: Torque Control".

A100 - Attributes

H1 Display : AF

Mess. no.: A100 (hex)

A101 Drive in VELOCITY control

The drive is in the velocity control operating mode. It follows the velocity command value sequence set by the control system. The velocity control loop is closed in the drive.

See also the functional description: "Mode: Velocity Control".

A101 - Attributes

H1 Display : AF

Mess. no.: A101 (hex)

A102 Position mode with encoder 1

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value with a systematical **lag** (following error).

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Mode: Position Control".

A102 - Attributes

H1 Display : AF

Mess. no.: A102 (hex)

A103 Position mode with encoder 2

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value with a systematical **lag** (following error).

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Mode: Position Control".

A103 - Attributes

H1 Display : AF

Mess. no.: A103 (hex)

A104 Position mode lagless, encoder 1

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value **without following (lag) error**.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of axis position).

See also the functional description: "Mode: Position Control".

A104 - Attributes

H1 Display : AF

Mess. no.: A104 (hex)

A105 Position control lagless, feedback 2

The drive is in **position control mode**. The position loop is closed in the drive by a position encoder. The control system only sets the position command value sequence; the drive follows the command value **without following (lag) error**.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Mode: Position Control".

A105 - Attributes

H1 Display : AF

Mess. no.: A105 (hex)

A106 Drive controlled interpolation, encoder 1

The drive receives a position command value from the control system which is identical to the **target position** of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.

The drive moves with a systematical **lag** (following error) to the target position.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Mode: Drive Internal Interpolation".

A106 - Attributes

H1 Display : AF

Mess. no.: A106 (hex)

A107 Drive controlled interpolation, encoder 2

The drive receives a position command value from the control system which is identical to the **target position** of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.

The drive moves with a systematical **lag** (following error) to the target position.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Mode: Drive Internal Interpolation"

A107 - Attributes

H1 Display : AF

Mess. no.: A107 (hex)

A108 Drive controlled interpolation, lagless, encoder 1

The drive receives a position command value from the control system which is identical to the **target position** of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence,

which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.

The drive moves **without following error** to the target position.

Encoder 1 indicates that the position encoder is installed on the motor shaft (indirect measurement of the axis position).

See also the functional description: "Mode: Drive Internal Interpolation".

A108 - Attributes

H1 Display : AF

Mess. no.: A108 (hex)

A109 Drive controlled interpolation, lagless, encoder 2

The drive receives a position command value from the control system which is identical to the **target position** of the travel path. Then the drive generates (**interpolates**) an internal position command value sequence, which uses the control system to maintain maximum values for jerk, velocity and acceleration sequences.

The drive moves **without following error** to the target position.

Encoder 2 indicates that the position encoder is installed on the machine axis (direct axis position measurement).

See also the functional description: "Mode: Drive Internal Interpolation".

A109 - Attributes

H1 Display : AF

Mess. no.: A109 (hex)

A146 Relative drive controlled interpolation, encoder 1

In the **S-0-0282, Travel distance** parameter, the drive receives a distance specification from the controller. When bit 0 of the **S-0-0346, Setup flag for relative command values** parameter is toggled, this distance is summed up to the value in **S-0-0258, Target position**. In order to get from the current position to the new target position, the drive now generates (interpolates) an internal position command value curve. This is done taking the limit values of velocity, acceleration, and jerk in the parameters

- **S-0-0259, Positioning velocity**
- **S-0-0260**, **Positioning acceleration**
- **S-0-0193, Positioning jerk**

into account.

The drive approaches the target position with a position lag that is proportional to the velocity.

Encoder 1 means that the position encoder is attached to the motor shaft (indirect measurement of the axis position).

See also the functional description: "Mode: Relative drive-internal interpolation".

A146 - Attributes

H1 Display : AF

Mess. no.: A146 (hex)

A147 Relative drive controlled interpolation, encoder 2

In the **S-0-0282, Travel distance** parameter, the drive receives a distance specification from the controller. When bit 0 of the **S-0-0346, Setup flag for relative command values** parameter is toggled, this distance is summed up to the value in **S-0-0258, Target position**. In order to get from the current position to the new target position, the drive now generates (interpolates) an internal position command value curve. This is done taking the limit values of velocity, acceleration, and jerk in the parameters

- **S-0-0259, Positioning velocity**
- **S-0-0260**, **Positioning acceleration**
- **S-0-0193, Positioning jerk**

into account.

The drive approaches the target position with a position lag that is proportional to the velocity.

Encoder 2 means that the position encoder that is attached to the load is used for closing the position control loop (direct axis position measurement).

See also the functional description: "Mode: Relative drive-internal interpolation".

A147 - Attributes

H1 Display : AF

Mess. no.: A147 (hex)

A148 Relative drive contr. interpolation, enc. 1, lagless

In the **S-0-0282, Travel distance** parameter, the drive receives a distance specification from the controller. When bit 0 of the **S-0-0346, Setup flag for relative command values** parameter is toggled, this distance is summed up to the value in **S-0-0258, Target position**. In order to get from the current position to the new target position, the drive now generates (interpolates) an internal position command value curve. This is done taking the limit values of velocity, acceleration, and jerk in the parameters

- **S-0-0259, Positioning velocity**
- **S-0-0260**, **Positioning acceleration**
- **S-0-0193, Positioning jerk**

into account.

The drive approaches the target position of the travel path without a position lag.

Encoder 1 means that the position encoder is attached to the motor shaft (indirect measurement of the axis position).

See also the functional description: "Mode: Relative drive-internal interpolation".

A148 - Attributes

H1 Display : AF

Mess. no.: A148 (hex)

A149 Relative drive contr. interpolation, enc. 2, lagless

In the **S-0-0282, Travel distance** parameter, the drive receives a distance specification from the controller. When bit 0 of the **S-0-0346, Setup flag for relative command values** parameter is toggled, this distance is summed up to the value in **S-0-0258, Target position**. In order to get from the current position to the new target position, the drive now generates (interpolates) an internal position command value curve. This is done taking the limit values of velocity, acceleration, and jerk in the parameters

- **S-0-0259, Positioning velocity**
- **S-0-0260**, **Positioning acceleration**
- **S-0-0193, Positioning jerk**

into account.

The drive approaches the target position of the travel path without a position lag.

Encoder 2 means that the position encoder that is attached to the load is used for closing the position control loop (direct axis position measurement).

See also the functional description: "Mode: Relative drive-internal interpolation".

A149 - Attributes

H1 Display : AF

Mess. no.: A149 (hex)

A206 Process block mode, encoder 1

The drive performs a closed loop position control with systematical lag. The actual value comes from the encoder 1 (motor encoder). The command value profile is generated in the drive.

Target position, velocity, acceleration and jerk are determined by a pre-programmed process block. Depending on **P-0-4019, Process block mode**, the target position is interpreted as an absolute value or as a relative distance to move.

See also the functional description: "Positioning Block Mode"

A206 - Attributes

H1 Display : AF

Mess. no.: A206 (hex)

A207 Process block mode lagless, encoder 1

The drive performs a closed loop position control without lag. The actual value comes from the encoder 1 (motor encoder). The command value profile is generated in the drive.

Target position, velocity, acceleration and jerk are determined by a pre-programmed process block. Depending on **P-0-4019, Process block mode**, the target position is interpreted as an absolute value or as a relative distance to move.

See also the functional description: "Positioning Block Mode"

A207 - Attributes

H1 Display : AF

Mess. no.: A207 (hex)

A208 JOG mode positive

The drive moves with a jogging velocity (P-0-4030) in the positive direction. The motor is turning clockwise, when viewing the motor shaft.

See also the functional description:"Operating Mode: Jogging"

A208 - Attributes

H1 Display : JF

Mess. no.: A208 (hex)

A210 Process block mode, encoder 2

The drive performs a closed loop position control with systematical lag. The actual value comes from the encoder 2 (ext. encoder). The command value profile is generated in the drive.

Target position, velocity, acceleration and jerk are determined by a pre-programmed process block. Depending on **P-0-4019, Process block mode**, the target position is interpreted as an absolute value or as a relative distance to move.

See also the functional description: "Positioning Block Mode"

A210 - Attributes

H1 Display : AF

Mess. no.: A210 (hex)

A211 Process block mode lagless, encoder 2

The drive performs a closed loop position control without lag. The actual value comes from the encoder 2 (ext. encoder). The command value profile is generated in the drive.

Target position, velocity, acceleration and jerk are determined by a pre-programmed process block. Depending on **P-0-4019, Process block mode**, the target position is interpreted as an absolute value or as a relative distance to move.

See also the functional description: "Positioning Block Mode"

A211 - Attributes

H1 Display : AF

Mess. no.: A211 (hex)

A218 JOG mode negative

The drive moves with a jogging velocity (P-0-4030) in the negative direction. The motor is turning counter clockwise, when viewing the

See also the functional description:"Operating Mode: Jogging"

A218 - Attributes

H1 Display : Jb

Mess. no.: A218 (hex)

A800 Unknown operation mode

There is no diagnosis for the activated operation mode.

A800 - Attributes

H1 Display : AF

Mess. no.: A800 (hex)

1.8 Diagnostic messages for basic initialization and after fatal System errors

Diagnostic Message Display: -0

The writable **data storage** of the drive controller is tested for its functional capability.

If an error is detected, this display will remain.

Diagnostic Message Display: -1

The hardware of the amplifier is beig initialized.

Diagnostic Message Display: -2

Cause:

The control **supply voltage of the encoder** is missing.

Remedy:

Exchange the hardware.

Diagnostic Message Display: -3

Initializing the parameters from the NovRam and calculating the respective data depending from the parameter contents.

Diagnostic Message Display: -4

Initializing and checking the **command communication**.

Diagnostic Message Display: -5

Initializing the system control.

Diagnostic Message Display: -6

Starting the system control.

Diagnostic Message Display: E1

Cause:

Processor fault, caused by static discharge, program error or hardware fault. More information is available via a terminal connected to the RS-232 interface.

Remedy:

Switch the amplifier off and on again; if the fault is still present, exchange the hardware. In any case inform the customer service.

Diagnostic Message Display: E2

Cause:

Test of the **RAM** on the programming module has shown an error. RAM defective or not plugged properly.

Remedy:

Switch off, check the plug connection and switch on again; if the error happens agains, exchange the firmware module.

Diagnostic Message Display: E3

Cause:

Caused by a hardware fault or by a static discharge, the 1st **watchdog** of the amplifier has triggered.

Remedy:

Switch the amplifier off and on again; if E3 appears again, exchange the amplifier. In any case inform the customer service. Please explain the exact circumstances under which the error occurred.

Diagnostic Message Display: E4

Cause:

Caused by a hardware fault or by a static discharge, the 2nd **watchdog** of the amplifier has triggered.

Remedy:

Switch the amplifier off and on again; if E4 appears again, exchange the amplifier. In any case inform the customer service.

Diagnostic Message Display: E5

Cause:

Test of the **dual-port-RAM** for command communication failed. Maybe the hardware for command communication is not plugged on properly.

Remedy:

Check the plug connection; if OK, exchange the amplifier.

1.9 Operation Status

Hereafter, the possible states of operation are listed alphabetically. These are shown with the display H1 on the device.

bb

"Ready for operation"

Refer to description **A013 Ready for power on**.

Ab

"Drive is ready"

Refer to description **A012 Control and power sections ready for operation.**

AF

"Drive enable"

According to the operation mode in use, you will find a more exact description of the display "AF" under the respective state diagnosis A101..A800.

AH

"Drive Halt"

Refer to description **A010 Drive HALT**.

Jb

"Jog backward"

Refer to description **A218 Jog negative**..

JF

"Jog Forward"

Refer to description **A208 Jog positive**..

P0

"Phase 0" (only with SERCOS communication)

P2

"Phase 2"

Refer to description **A002 Communication phase 2**.

P3

"Phase 3"

Refer to description **A003 Communication phase 3**.

PL

"Basic Parameter Load"

See also: **F209 PL Load parameter default values.**

UL

"Basic Load"

See also: F208 UL The motor type has changed.

1.10 Diagnostic LEDs

Diagnostic LEDs for Profibus

There are four LEDs on the front of the fieldbus module used in fieldbus interface diagnoses. These signal the synchronization state between fieldbus interface and drive as well as the bus activity for cyclical data exchange.

LED designation	LED state	Definition
H30	ON	cyclical process data channel active
H31	--	--
H32/H33	alt. flashing	fieldbus module and drive synchronized
H32/H33	steady flashing	fieldbus module and drive not synchronized

Fig. 1-1: Diagnostic LEDs for Profibus

Diagnostic LEDs for INTERBUS

The LEDs on the Interbus of the DKC04.3 meet the requirements for an INTERBUS certification.

	LED designation	LED status	Definition
Remote Check	H40/RC	green	command cable OK
Bus Active	H41/BA	green	data exchange active
Transmit/receive	H42/TR	green	PCP transmission active
Remote bus disable	H43/RD	red	continuing remote bus segments off
Module status	H44	green flashing	Communication fieldbus drive OK
	H44	orange flashing	Communication fieldbus drive faulty
	H44	red	Initialization failed. Module defective
LED operation	H45/UL	green	voltage source OK

Fig. 1-2: Diagnostic LED for INTERBUS

Diagnoses for LED for CANopen

For fieldbus interface diagnoses there are six LEDs on the front of the fieldbus module. These signal the state of synchronization between fieldbus interface and drive as well as bus activity for cyclical data exchange.

Each LED can accept any of the four states, namely, red, green, orange and off .

When running up the CANopen module, the LEDs are automatically tested which can be seen by the glowing the various colors.

LED definition when module in operation:

	LED design.	**LED state**	**Definition**
intern synchronization	H50	orange flashing	no synchronization of fieldbus module with drive
		red/green flashing	synchronization of fieldbus module with drive established
--	H51	--	--
--	H52	--	--
SYNC	H53	orange	SYNC messages are being received. The LED toggles with each received SYNC from red to green. with the generally high frequencies, the prisma appears orange.
Initialization	**H54**	red	Initializing failed, module defective
		green	**module OK**
LED	**H55**	red	Operating error (Bus off). Too many errors on bus detected. Possible causes: • wrong baudrate • cable defective
		green	**operation OK**

Fig. 1-3: Diagnoses for LED for CANopen

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ECODRIVE03

Drive for General Automation
with Fieldbus-Interfaces

Supplement C
Serial Communications
FGP 02VRS

DOK-ECODR3-FGP-02VRS**-FKB1-EN-P

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Notes

1 Serial Communications

1.1 An Overview

The drive controller is equipped with a serial interface. It supports the parametrization of the drive. Using this interface, it is possible to alter:

- **Parameters**
- **Commands and**
- **Diagnoses**

Interface mode

The interface can be operated in either

- **RS232 mode** or
- **RS485 mode**

Interface protocol

Two different protocols are supported:

- the Indramat **SIS protocol**
  The usable data are transmitted in INTEL format.
- and an **ASCII protocol**

Its precise structure is outlined in the following section.

Note: If an ASCII protocol is used, then the number of bytes differs from the data length in the parameter description (internal number format).

1.2 Pertinent Parameters

The data exchange which implements the serial interface is controlled by means of the following parameters:

- **P-0-4021, Baud rate RS-232/485**
- **P-0-4022, Drive address**
- **P-0-4050, Delay answer RS-232/485**

1.3 Function Principle

Basic State once the Control Voltage is Switched On

After the control voltage is switched on, serial communications in the drive is in "**Passive mode**". Communications is not possible in passive mode.

Selecting a Protocol

To be able to take up serial communications with the drive it is necessary to set the communications mode (protocol)

- with a "**Change Drive" command** (with **ASCII protocol**)
- or a valid **Start telegram** (with **SIS protocol**).

Note: Internally, the first detected protocol that is valid (SIS or ASCII) is switched into. If a different protocol is to be used at some later point in time, then this is only possible by switching the 24 volt power supply off.

Note: The two listed options for establishing a connection, are extensively described in the section on Communications procedures.

Setting the Drive Address

The drive address is set via the serial interface by write accessing communications parameter **P-0-4022, Drive address.** DriveTop or a PLC can be used for this purpose.

Exception:

If value "**256**" is entered into communication parameter **P-0-4022,** then the unit address set via the address switch will be used for serial communications and not the value used in **P-0-4022.**

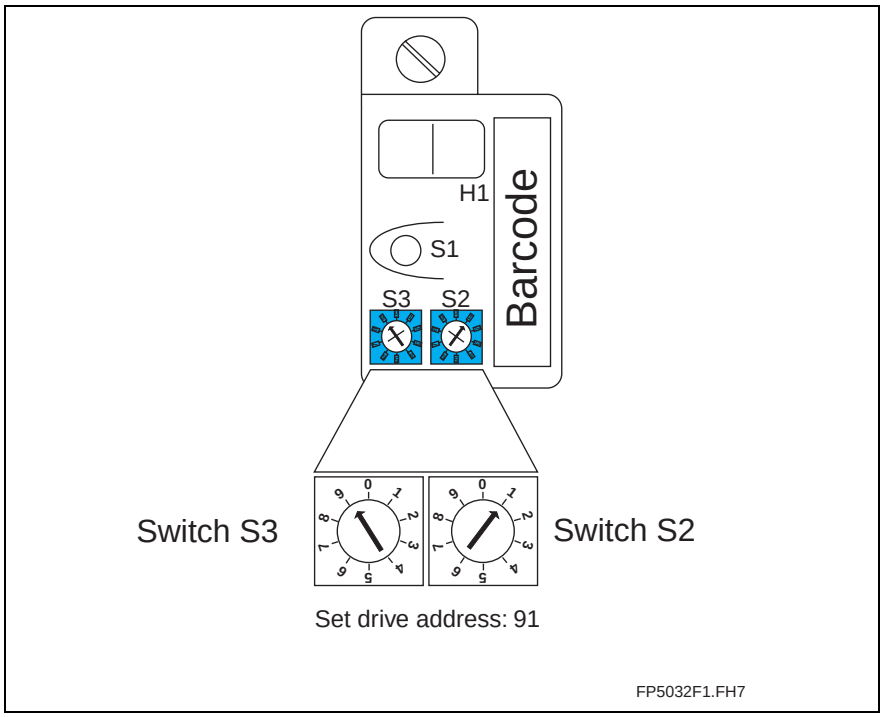


Fig. 1-1: Setting the address via the address switch on the programming module

RS485 mode It is only absolutely necessary to set the drive address if communications uses the **RS485 bus** because each bus participant will be addressed at a specific bus address.

Note: To avoid accessing conflicts, assign each drive address only once.

RS232 mode This mode does not necessitate the setting of drive address because only one participant is connected (peer-to-peer connection).

Communications via RS232 Interface

Features:

The RS232 interface is intended for use when connecting a PC with the **DriveTop** startup program.

- Transmission rate: 9600 and 19200 baud
- Maximum transmission path: 15m
- 8-bit **ASCII** protocol or 8-bit **SIS** protocol
- no parity bit
- a stop bit

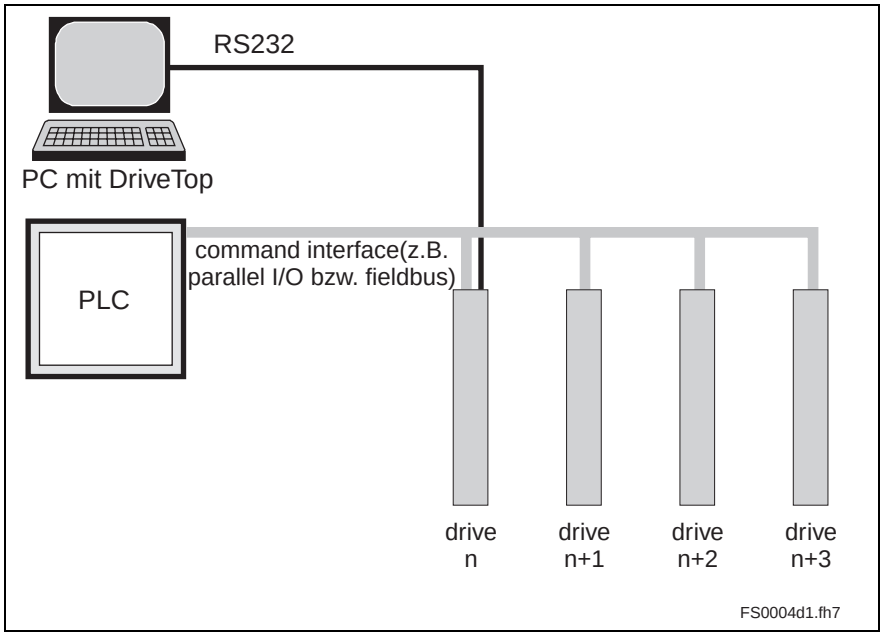


Fig. 1-2: Communications via RS 232 interface

Communications via RS485 Interface

Features

Communications via RS485 interface helps implement a **serial bus** with the following data:

- Up to **31 drives** can be connected to one bus master.
- Transmission rates of: **9600** and **19200** baud
- Maximum transmission path: **500m**
- **Half duplex** mode over a **2-wire** line
- 8-bit **ASCII** protocol or 8-bit **SIS** protocol
- no **parity bit**
- a stop bit

Operting Several Drives with DriveTop

Application advantages:

- Starting up several drives without replugging an interface cable (central parametrization and diagnostics connection).
- Implementing a central PC-supported visualization unit.

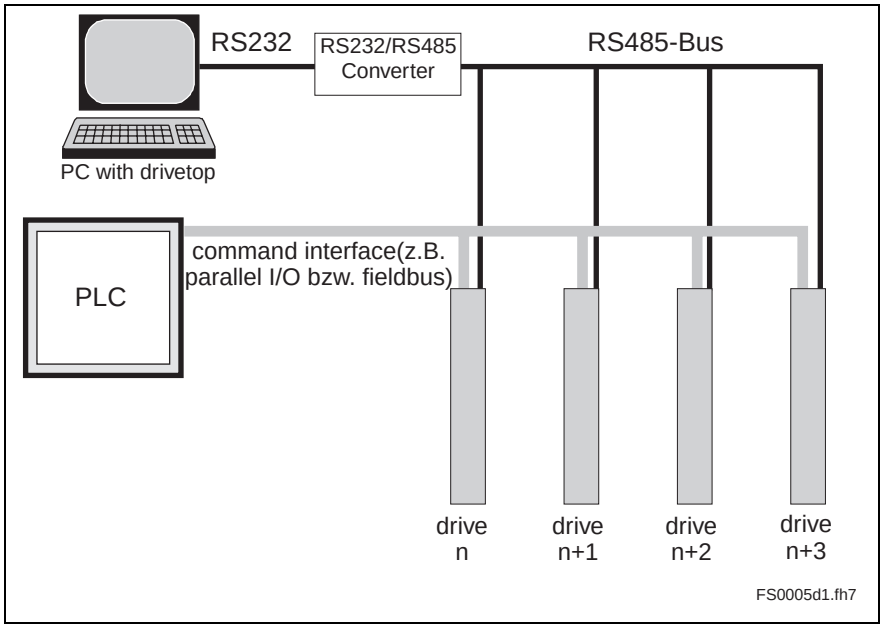


Fig. 1-3: Operating several drives with DriveTop

Parametrization and Diagnosing with a PLC

Application advantages:

- Parameters can be changed with a PLC (e.g., adjuting positioning blocks).
- Expanded diagnostics options for the PLC by reading in error codes.

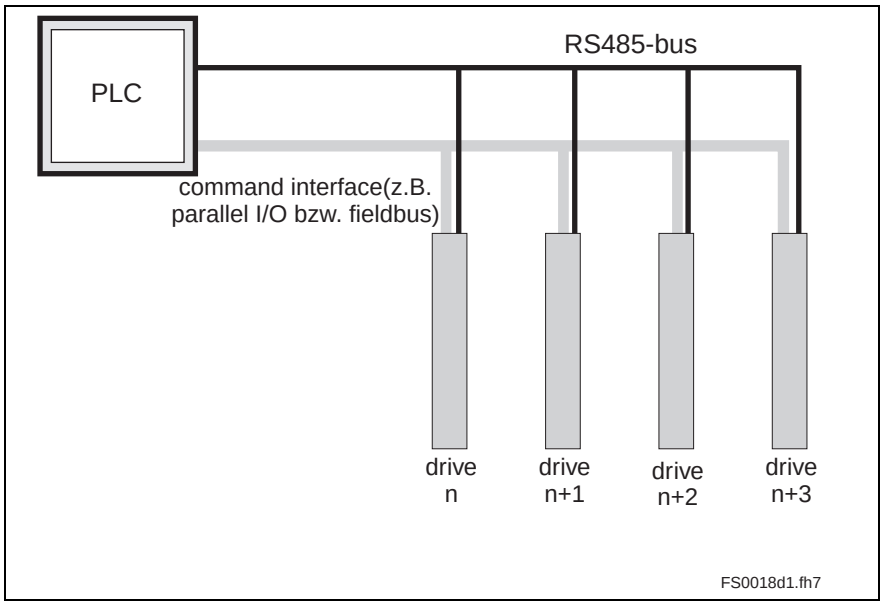


Fig. 1-4: Parametrizing and diagnosing with a PLC

Parametrization and Diagnosing Drive Groups Using a Control Unit

Application advantages:

- Using a central visualization unit.

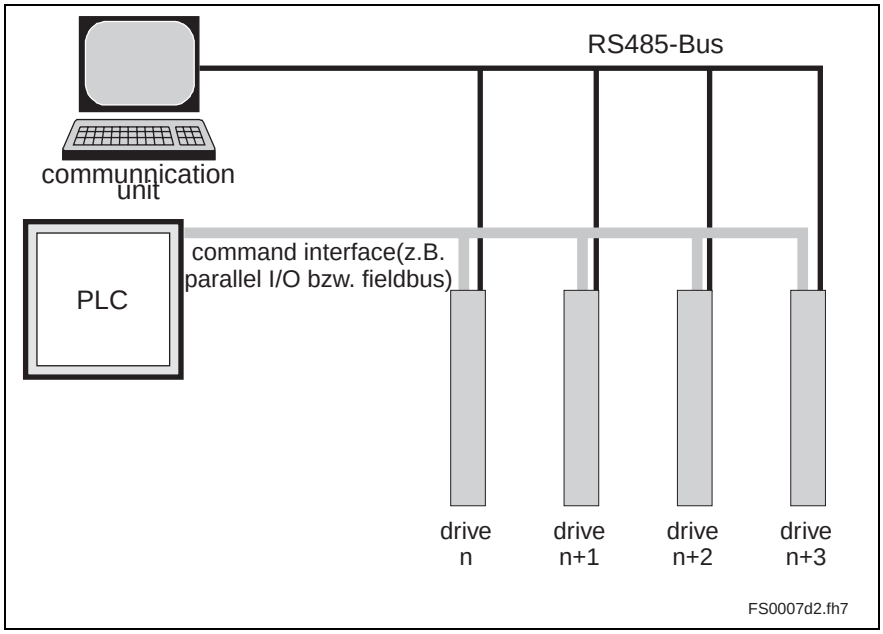


Fig. 1-5: Parametrization and diagnoses of drive groups using a control unit

1.4 Transmission Protocols

When switching on the 24V power voltage, an automatic protocol detection is activated upon receipt of a symbol from the serial interface.

As soon as either:

- a valid SIS start telegram
- or a valid ASCII start sequence ("bcd:address")

has been received, there is an internal switching to the relevant protocol and baud rate.

The drive supports two different protocols:

- ASCII protocol
- SIS protocol

These are explained below in greater detail.

ASCII Protocol

Features:

- Transmission rates of: **9600** and **19200** baud
- Maximum transmission path: 1**5m**
- 8-bit **ASCII** protocol
- no **parity bit**
- a stop bit

Structure, Telegram frame:

In this case, **no telegram frame** is used, but instead the transmitted ASCII symbol is converted and interpreted. It is only necessary to maintain a specified order.

SIS protocol

Features:

- This is a **binary protocol.**
- A checksum test is conducted (higher Hamming distance D).
- All telegrams are identified by an unequivocal start symbol.
- There is a defined telegram frame structure.
- It is possible to trigger movements via an SIS telegram (e.g., jogging).

Structure, Telegram frame:

An SIS telegram is basically broken down into three blocks:

- Telegram head
- user data head
- user data head

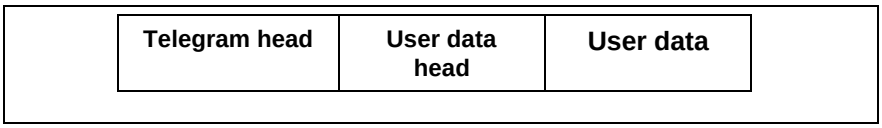


Fig. 1-6: The structure of an SIS telegram

Telegram Head Structure

Byte	name	Definition of the individual telegram bytes
1	StZ	Start symbol: STX (0x02)
2	CS	This is the checksum byte. It is generated by adding all subsequential telegram symbols as well as the start symbol StZ and concluding negation. In other words, the sum of all telgram symbols always equals 0 if the transmission was successful.
3	DatL	The length of the subsequential user data and the variable part are in the frame protocol. Up to at least **247 bytes** (255 - 7 {subaddresses} - 1 {running telegram number}) user data can be transmitted in one telegram.
4	DatLW	The repetition of DatL takes place here. The telegram length is generated from the DatLW and the fixed part of the frame protocol (byte 1 - 8), i.e., telegram length = DatLW + 8.
5	Cntrl	Bit 0 - 2: Number of subaddresses in the address block (0 - 7), Bit 3: 'running telegram number' : 0 => not supported, 1 => additional byte Bit 4: 0 => command telegram, 1 => reaction telegram Bit 5 - 7: Status data for the reaction telegram: 000 no error, request was processed 001 transmission request being processed 010 transmission cannot presently be processed 100 warning 110 error
6	Service	This specifies the service that the sender is requesting of the receiver or which the receiver is conducting. 0x00 ... 0x0F general services 0x00 participant ID 0x01 terminate a data transmission 0x02 Flash operation 0x03 Initialization of SIS communication 0x0F Token Passing 0x10 ... 0x7F presently reserved 0x80 ... 0x8F special services for ECODRIVE 0x90 ... 0x9F special services for SYNAX 0xA0 ... 0xAF special services for MT-CNC or MTC200 0xB0 ... 0xBF special services for ISP200 0xC0 ... 0xCF special services for CLC-GPS 0xD0 ... 0xDF special services for HMI system 0xE0 ... 0xFF presently reserved
7	AdrS	Address of the sender: station number (0 - 127)
8	AdrE	Adress of the receiver: AdrE = 0 - 127 ==> specifies a single station, AdrE = 128 - 254 ==> addresses logical groups, AdrE = 255 ==> fixes a broadcast Telegrams with AdrE = 128 - 255 are **not** answered with a reaction telegram.
9	AdrES1	Subaddress 1 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 000**
10	AdrES2	Subaddress 2 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 001**
11	AdrES3	Subaddress 3 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 010**
12	AdrES4	Subaddress 4 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 011**
13	AdrES5	Subaddress 5 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 100**
14	AdrES6	Subaddress 6 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 101**
15	AdrES7	Subaddress 7 of the receiver, **if for Bit 0 - 2 if for byte control it applies that: > 110**
16	PaketN	running telegram number (package number), **if bit 3 in byte cntrl has been set**

Fig. 1-7: SIS-Telgram head

Structure of the User Data Head

Note: The structure of the user data head depends on the transmission direction. Also the user data headers, described here are only used for the services 8x80…0x8F

It is differentiated between:

- **Command telegram** (Master --> Slave):

This is the telegram that the master sends to the slave (drive) !

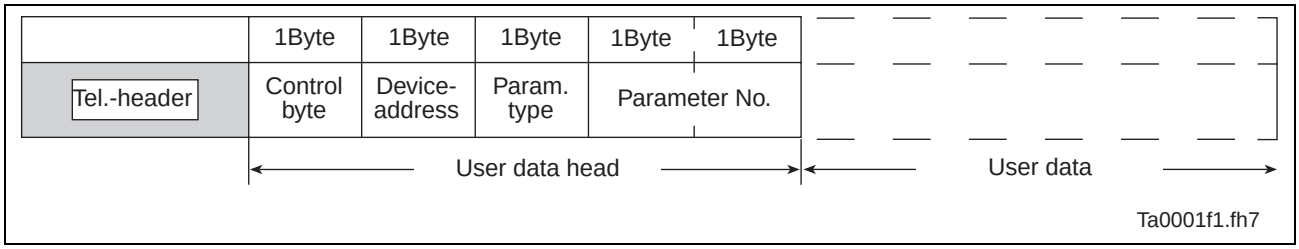


Fig. 1-8: User data head structure in the command telegram

- **Reaction telegram** (Slave--> Master):

This is the telegram that the slave sends to the master (Drive)!

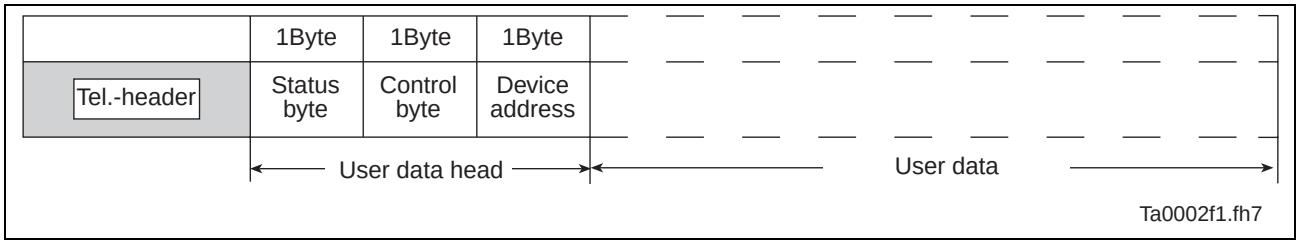


Fig. 1-9: User data head structure in reaction telegram

The definition of the user data head

The user data head describes the mode of transmission in the command telegram.

Control byte

The data block element of a parameter which is being accessed is described in the control byte. Bit 2 is used to control the transmission of following telegrams (the writing of lists in several increments).

Unit address

The unit address set at the address switch must be entered here.

Parameter Number and Type

The parameter number has the format set in the SERCOS interface specification. To be able to address control parameters as well, 1 byte is set in front of the address to identify the parameter type.

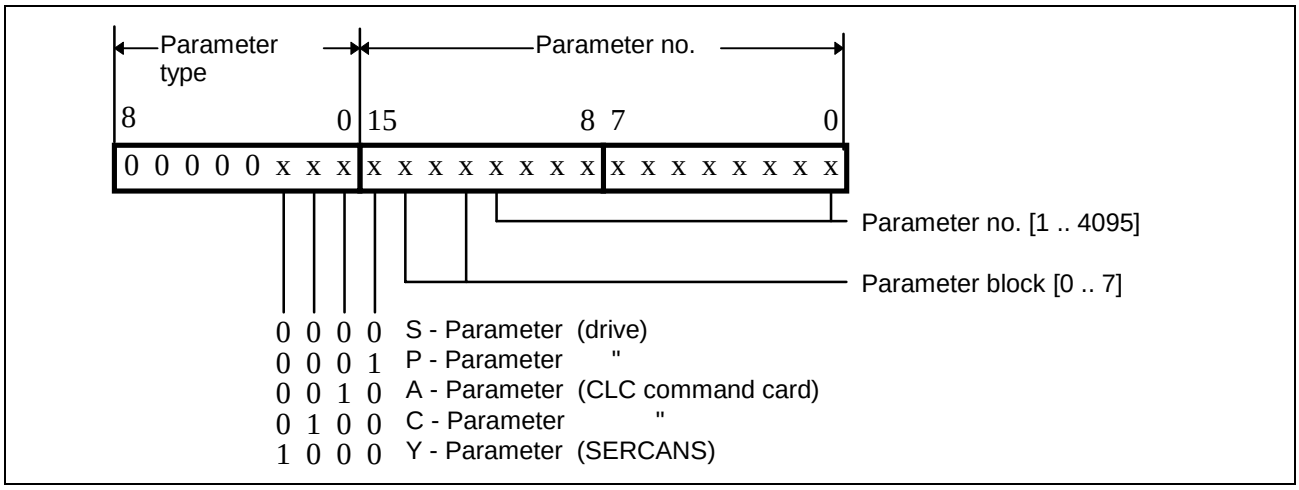

Parameter type
Parameter no.
8 0 15 8 7 0
0 0 0 0 0 x x x x x x x x x x x x x x x x
Parameter no. [1 .. 4095]
Parameter block [0 .. 7]
0 0 0 0 S - Parameter (drive)
0 0 0 1 P - Parameter "
0 0 1 0 A - Parameter (CLC command card)
0 1 0 0 C - Parameter "
1 0 0 0 Y - Parameter (SERCANS)

Fig. 1-10: Parameter number and type in user data head

Structure of the User Data Field

Values of any kind can be entered in the user data byte. These cans can be interpreted as needed by a specific service. For example, binary symbols are entered into the user data during flash programming and the decimal value when writing a parameter. The length of the user data field is set with both the DatL and DatLW bytes in the telegram head.

1.5 Communications procedures

General Information on the Parameter Structure

All parameters of the drive controller are stored in a uniform parameter structure. Each parameter is made up of 7 elements. The table below describes the individual elements and access possibilities. The parameter structures illustrated here will be referenced in the following sections.

Element no.	Data block element	Access posibilities
1	ID number	read
2	name	read
3	attribute	read
4	unit	read
5	min. input value	read
6	max. input value	read
7	operating data	read / write

Fig. 1-11: Parameter structure

Note: Attached is a parameter description with detailed data of the features of all available parameters.

Communicating with an ASCII Protocol

Actuating a Specific Bus User

To communicate with a bus user then it must be directly addressed with a CHANGE DRIVE command, specifying the drive address. With each CD command, the drive specified by the address is activ. All other ddrives are switched into passive mode. The addressed drive signals with a prompt. As of this point, all further communication takes place with this drive until another CHANGE DRIVE command switches to another drive.

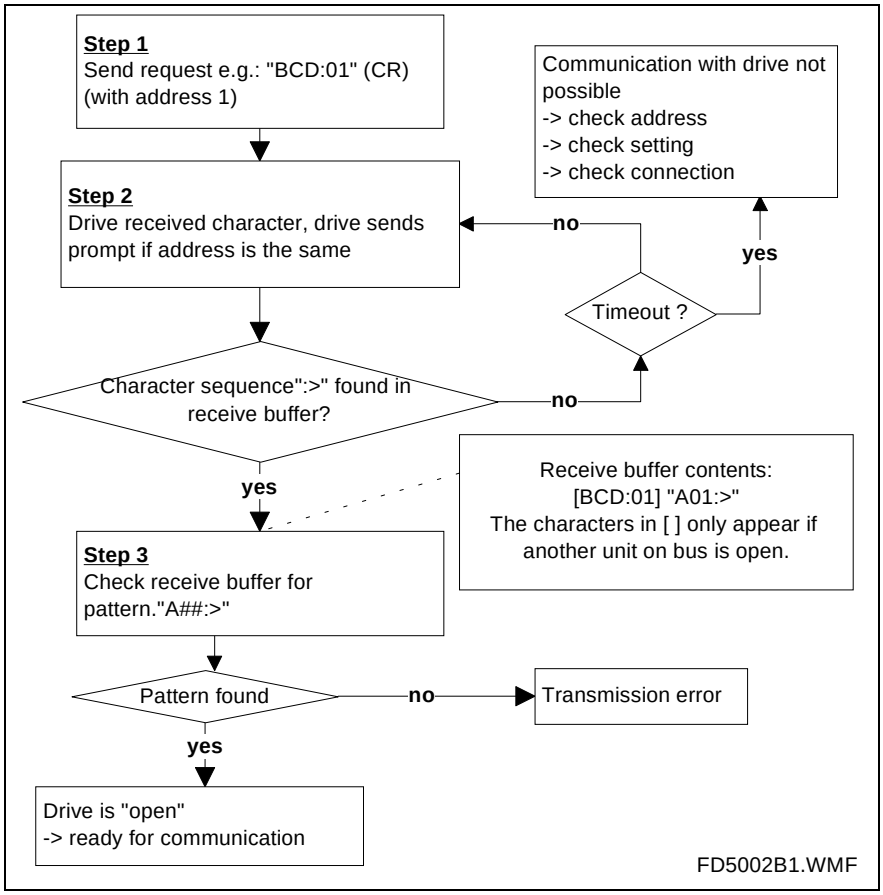


Fig. 1-12: Actuating a bus user

Write Accessing a Parameter

The write accessing of a parameter generally takes place as follows:

ID number of parameter, data block element number, with operating data (Carriage Return)

Once a write operation is completed, the drive signals with a prompt.

To access the parameter value of parameter P-0-4037, for example, the following must be input:

Note: All data entered must correspond to the data type set in the attribute (HEX, BIN, DEZ).

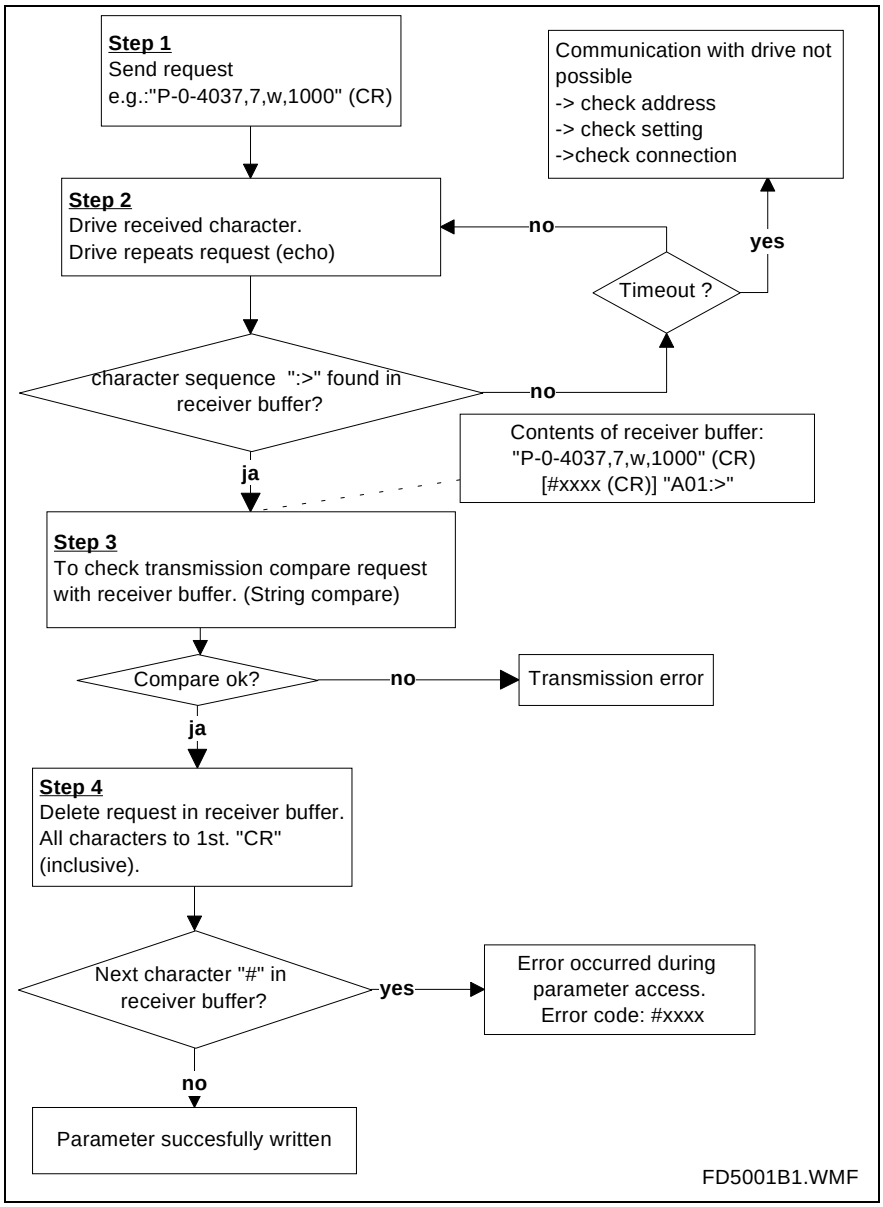


Fig. 1-13: Write accessing a parameter

Also see error messages.

Read Accessing a Parameter

Read accessing a parameter looks like this :

ID number of parameter, data block element number (Carriage Return)

The drive plays back the contents of the addressed data block element.

To access the operating data of parameter P-0-4040, for example, the following must be input:

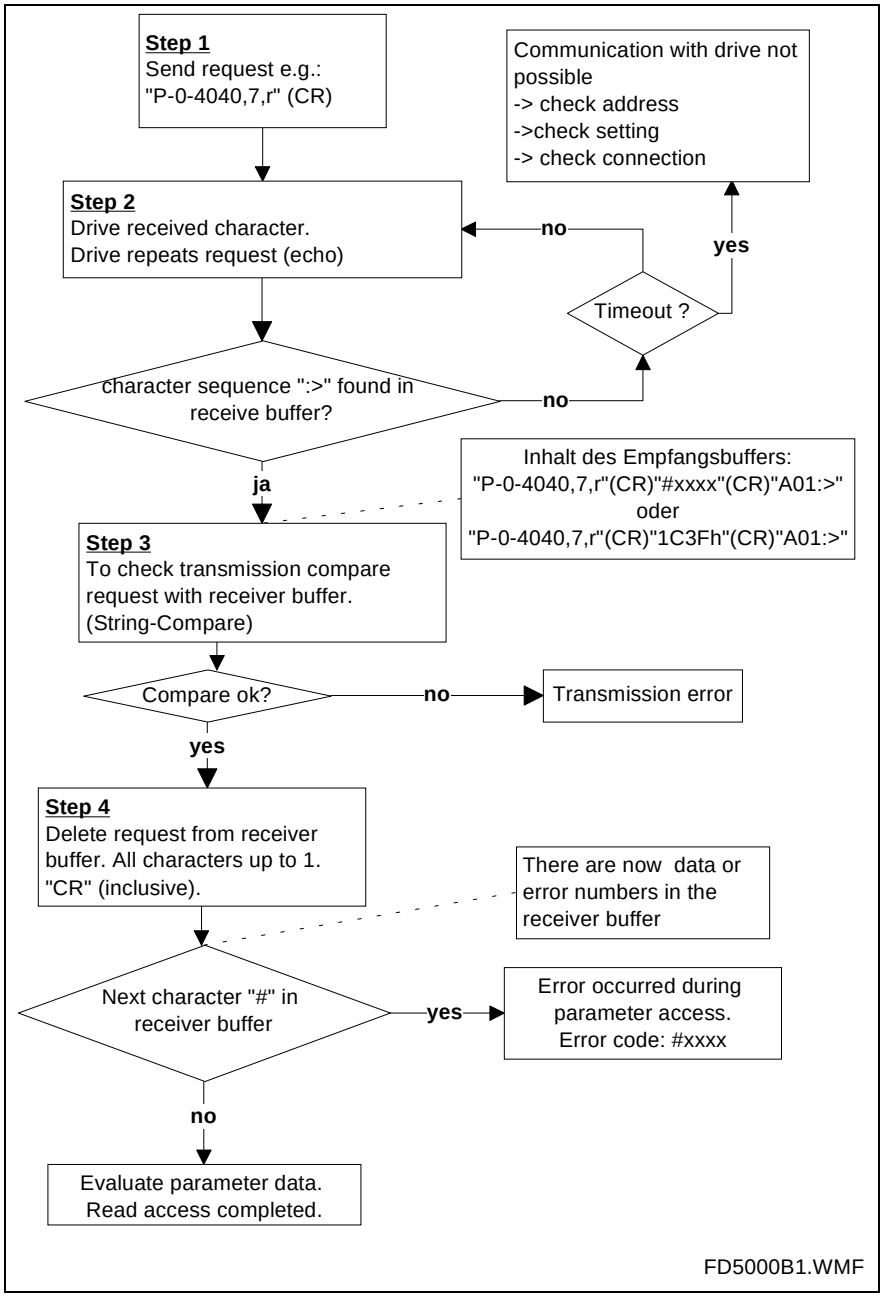


Fig. 1-14: Read accessing a parameter

Write Accessing List Parameters

There are a number of lists in the drive. These can be addressed when writing in a modified way.

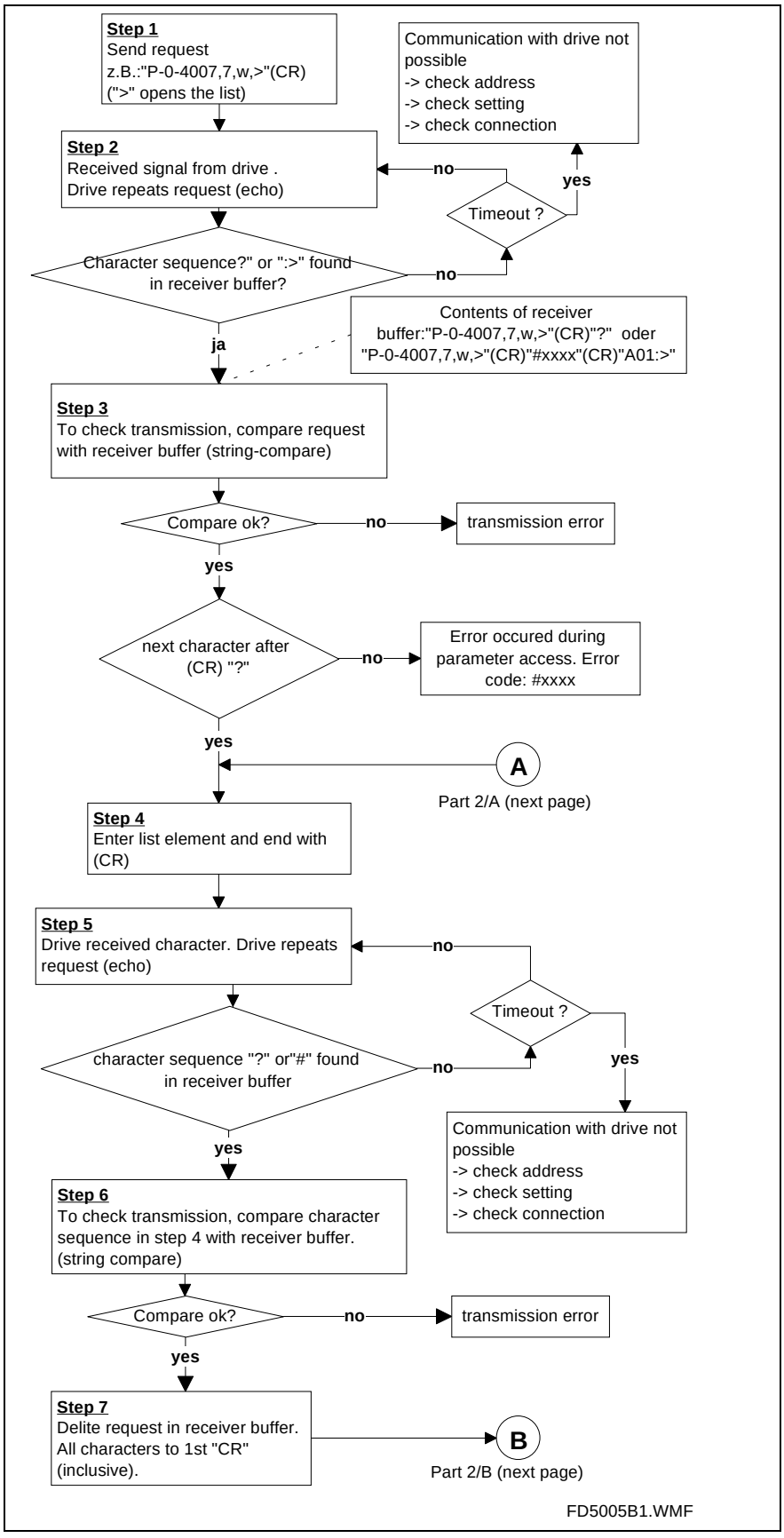


Fig. 1-15: Write accessing list parameters (part 1)

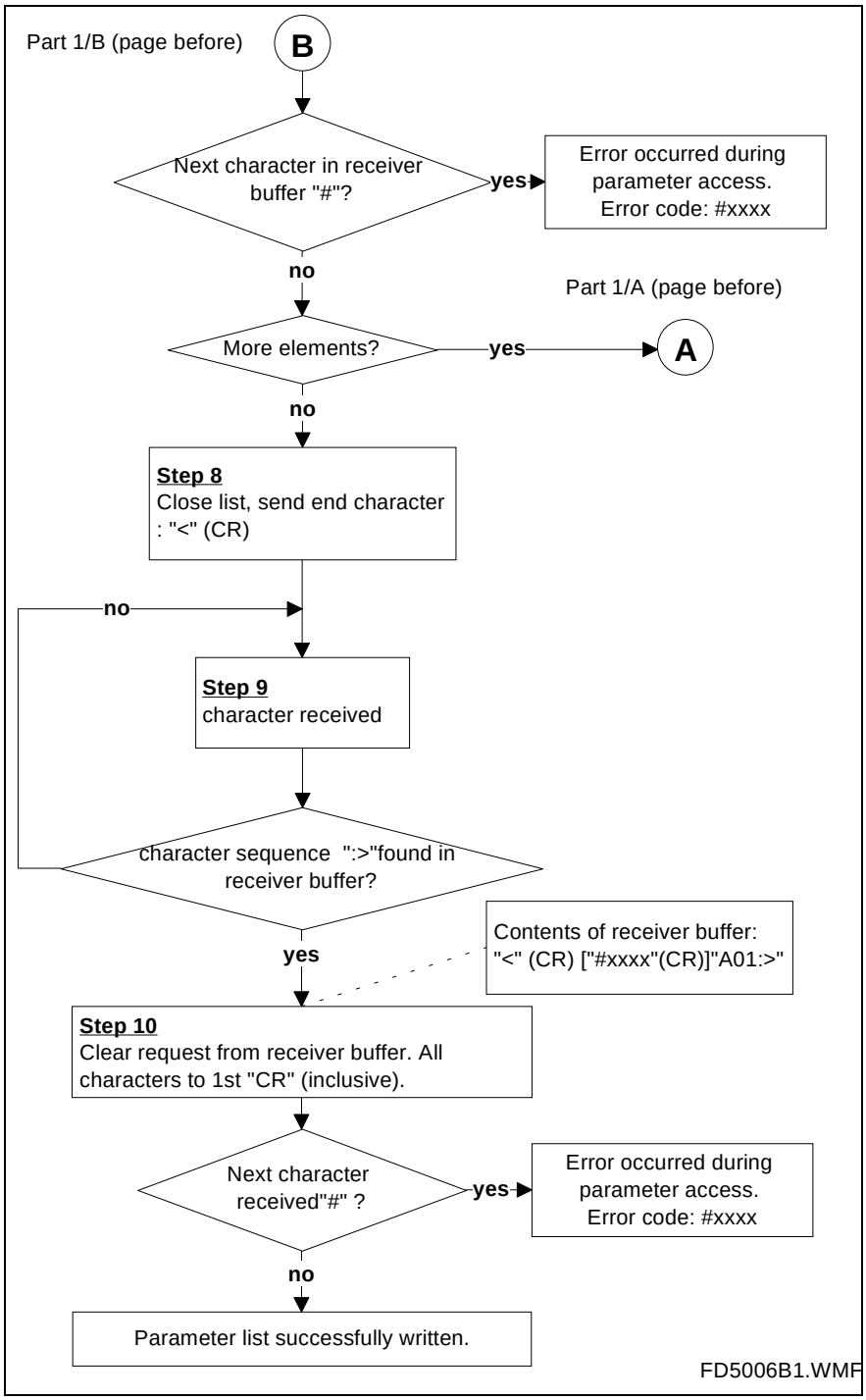


Fig. 1-16: Write accessing list parameters (part 2)

It is important to conclude the input with a "<" symbol as only then will be the data be assumed in the drive.

Reading Accessing List Parameters

List parameters are read accessed in the same way as normal parameters. The drive supplies a list element as response, however.

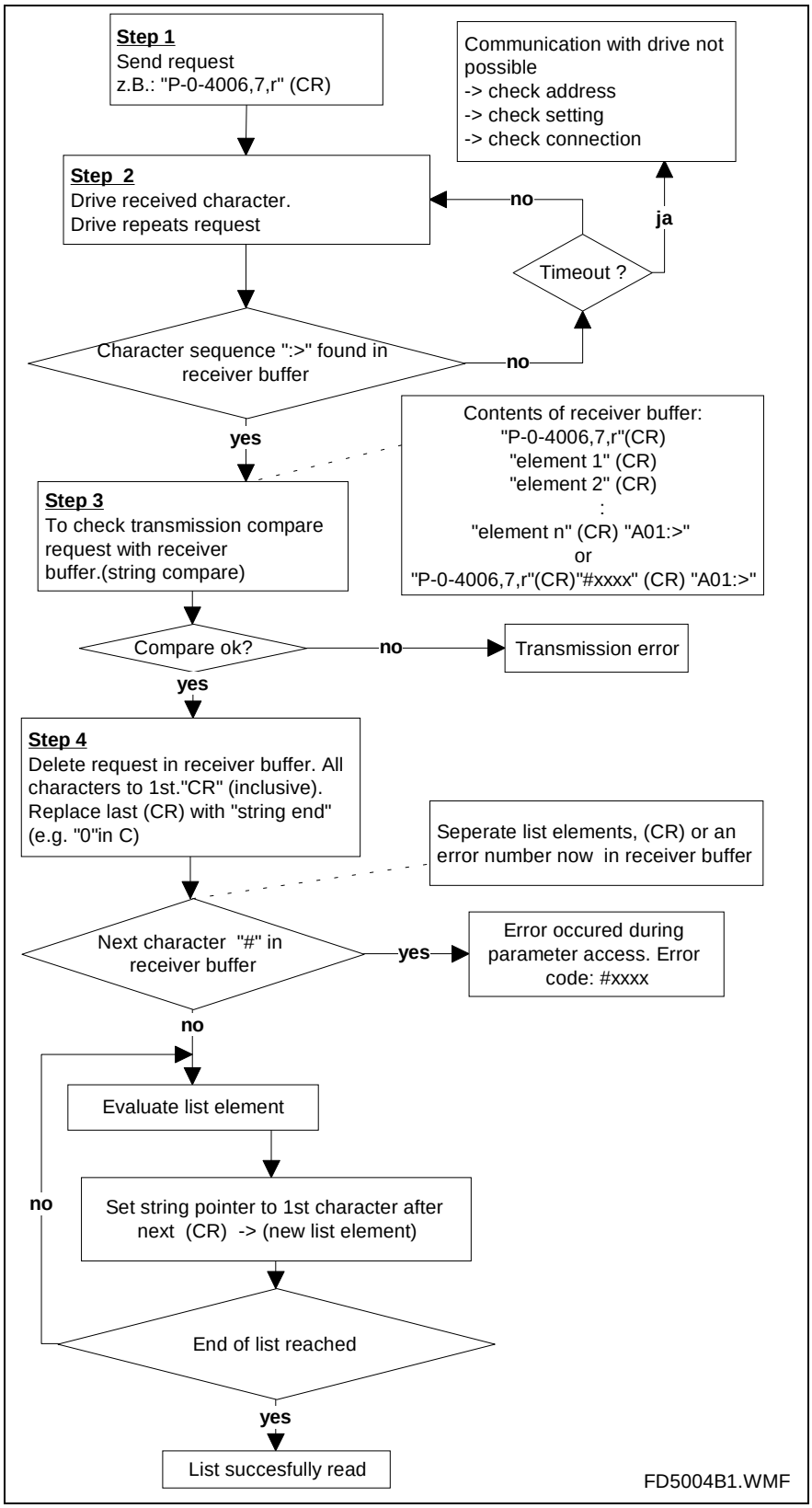


Fig. 1-17: Read accessing list parameters

Starting a Command

Numerous commands can be conducted in the drive controller . Command execution takes place automatically in the drive.

There are commands for:

- **Switching between operating and parametrization modes: S-0-0127, C100 Communication phase 3 transition check S-0-0128, C200 Communication phase 4 transition check P-0-4023, C400 Communication phase 2 transition**
- **S-0-0262, C700 Command basic load**
- **S-0-0099, C500 Reset class 1 diagnostic**
- **S-0-0148, C600 Drive controlled homing procedure command**
- **P-0-0012, C300 Command 'Set absolute measurement'**

A command can be started, terminated and completed via the serial interface. The status of command execution can also be read.

A command is started as follows:

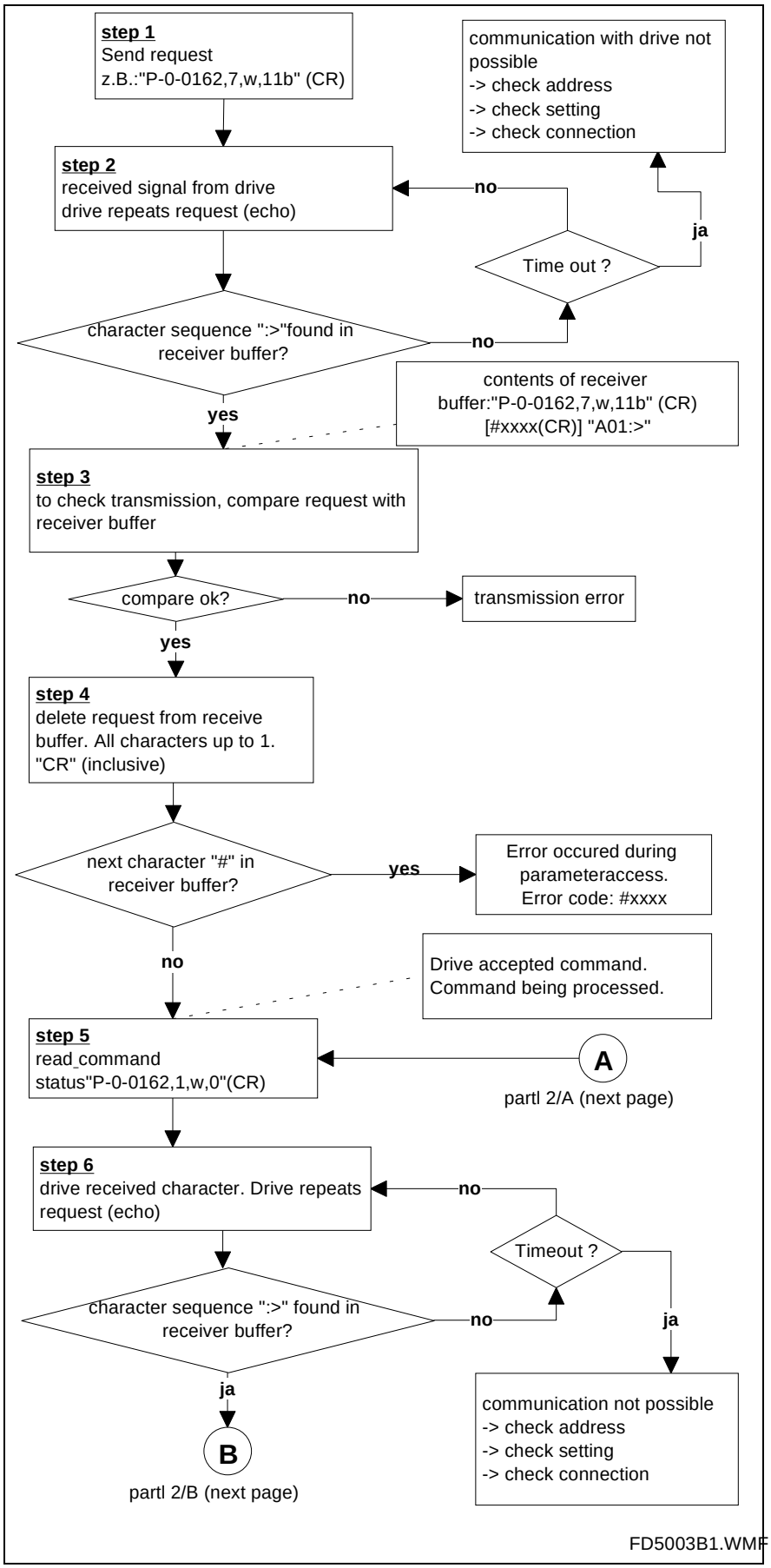


Fig. 1-18: Starting a command, part 1

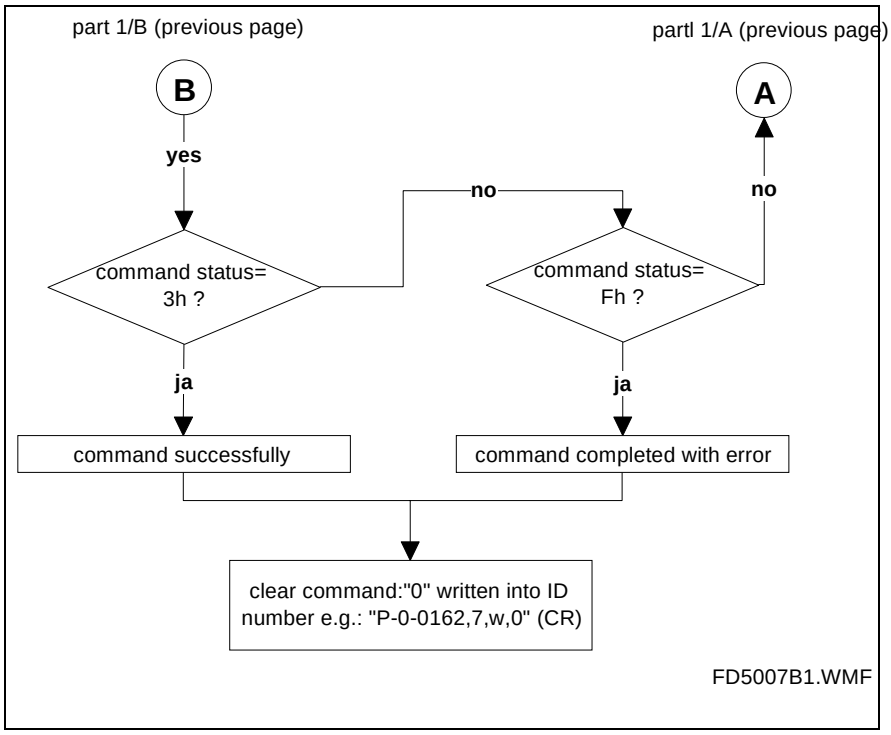


Fig. 1-19: Starting a command, part 2

Querying Command Status

The current status of a command can be queried. By doing so, it can be ascertained that the drive has concluded command execution before the control (or PC) has ended the command.

The command status is queried as follows:

ID number of command,1,w,0 (Carriage Return)

The drive signals the current command status after the ID number of the command parameter is written.

Possible status messages:

0 h	command not set in drive
1 h	command set in drive
3 h	command set, released and properly executed
5 h	command set in drive and enabled
7 h	command set and enabled, but not executed
F h	command set and enabled, but not executed, as error present

Fig. 1-20: Status messages

The command status is transmitted in bit list form. The definition of the individual bits is illustrated below.

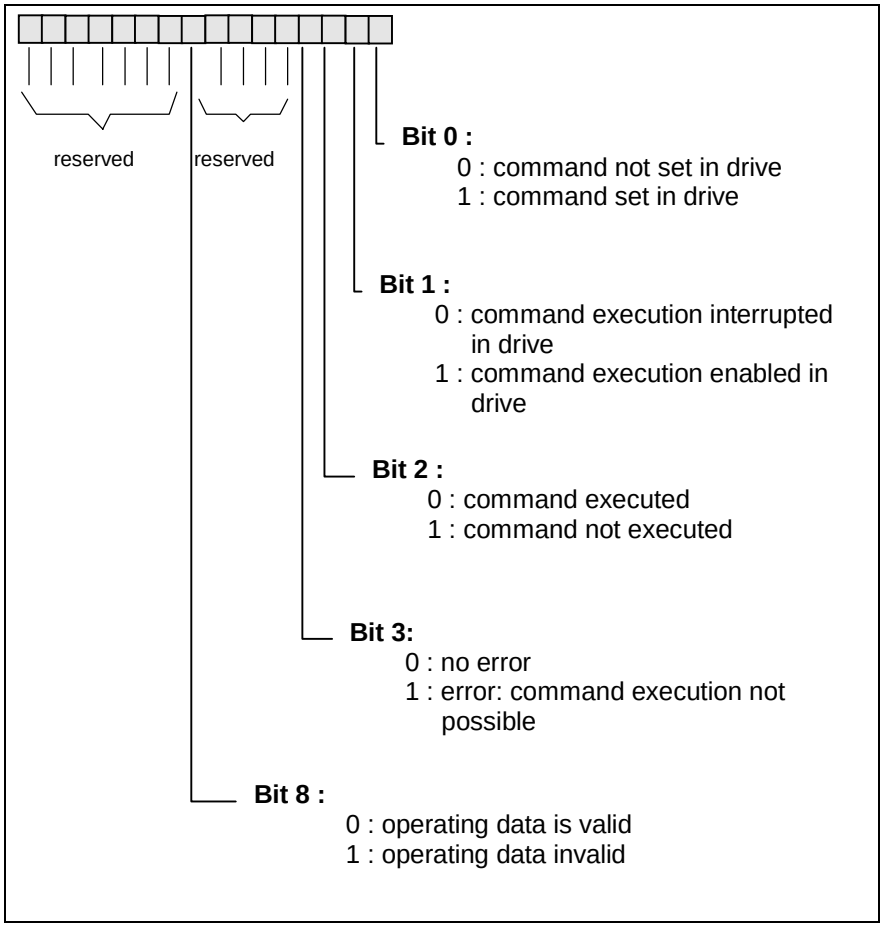

reserved
reserved
Bit 0 :
0 : command not set in drive
1 : command set in drive
Bit 1 :
0 : command execution interrupted in drive
1 : command execution enabled in drive
Bit 2 :
0 : command executed
1 : command not executed
Bit 3:
0 : no error
1 : error: command execution not possible
Bit 8 :
0 : operating data is valid
1 : operating data invalid

Fig. 1-21: Command acknowledgement (data status)

Ending a command

A command is ended as follows:

ID number of command,7,w,0 (Carriage Return)

Communicating with the SIS protocol

Actuating a Drive via an SIS protocol

When communicating with SISprotocols, a difference is made between **comand telegram** and **reaction telegramm** depending on transmission direction. A user can only be addressed if a specific telegram format (frame) is maintained at his address (see programming module).

Note: Only after the drive has received at least a valid SIS telegram is the SIS channel free for further communications.

The individual **access modes** are described briefly below before the individual **services** are explained.

General information about read accessing

If a command telegram is used to start a read of a parameter, then the drive checks whether a **following telegram is needed.** In this case, the reaction telegram in the control byte is retained in

Bit 2 (running / final transmission) at "**0“** until the final reaction telegram is sent. Bit 2 is set to 1 herein.

The transmission of a following reaction telegram is triggered by the renewed transmission of an unchanged command telegram.

General information for following telegram accessing

If write or read of a parameter is started in the drive with a following telegram, then this must be concluded of terminated before a different service can be started. If a different service was started anyway, then error code **0x800C "unallowed access**“ is sent in the reaction telegram. The previously started service with following telegrams can then be processed as usual in the next command telegram, or terminated.

A difference is made between

- **general** and
- **special services**.

Service 0x01 Terminating a Data Transmission

Command telegram

- Enter 0x01 in the service of the telegram head.
- Enter the terminated service in the user head.

Reaction telegram

If there is **no error,** then the reaction telegram has the following structure:

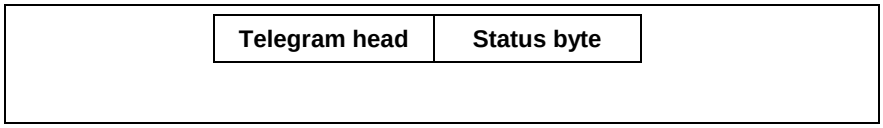


Fig. 1-22: Structure of the reaction telegram

If there is an **error,** then user data containing the error codes are sent. The user data head corresponds to the SIS specificaiton.

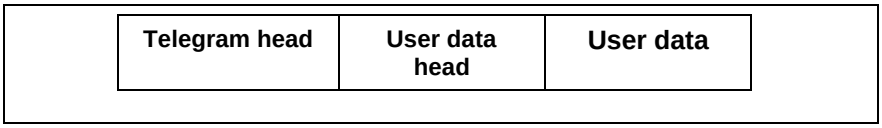


Fig. 1-23: Structure of the reaction telegram

Note: If no following telegrams are processed but this service is sent anyway, then no error reaction telegram will be sent!

Service 0x0F Token Passing

Note: This service is not suppported in ECODRIVE!

Reaction telegram

Error code 0x0F "**Invalid service**" is sent in the status byte of the des **user data**.

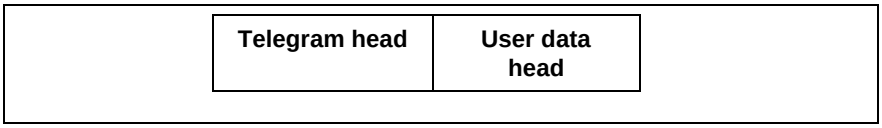


Fig. 1-24: Structure des Reaction telegrams

Service 0x80 read a parameter

Command telegram

- Enter **0x80** in the service of the telegram head.
- Enter the parameter to be read in bytes **Parameter type** and **Parameter no**. of the user data head.
- Do not enter **user data bytes**.

Reaction telegram

- Using bit 2 the running / final transmission is designated in the control byte of the reaction telegram.

Service 0x81 Read a List Segment

Command telegram

- Enter **0x81** in the service of the telegram head.
- Parameter type and parameter no. of the parameter to be read must be entered in the user data head.
- in the user data bytes 0 and 1 of the **offset** within the list as word =16 Bit
- in user data bytes 2 and 3 the **number** of the **words** to be read

Reaction telegram

- Bit 2 identifies the running / final transmission in the control byte of the reaction telegram.

Note: The output of a following telegram is started by a renewed transmission of the unchanged command telegram.

Service 0x8E write a list segment

Command telegram

- Enter **0x8E** in the service of the telegram head.
- Enter parameter type and number of the parameter to be read in the user data head.
- in user data bytes 0 and 1 of the **offset** within the list as word =16 Bit
- in user data bytes 2 and 3 the **number** of the **words** to be written

Reaction telegram

- Any occurring errors are entered in the user data of the reaction telegram.

Note: Only list segments can be processed with this service that are contained in the present list. If the actual list length is to be changed, then this change must be specified. It is not possible to operate in following telegram mode.

Service 0x8F write a parameter

Command telegram

- Enter 0x8F in the service of the telegram head.
- Enter the parameter to be written into into in parameter type and number bytes of the user data head.
- Enter the value to be written into the user data head.

Reaction telegram

Note: This service can be used to start all commands in the drive.

Starting a command

Via the SIS interface all commands in the drive can be started with Service **0x8F "write a parameter“**.

Telegram head	User data head	1 byte user data

Fig. 1-25: Structure of the command telegram

- Enter 0x8F in the service of the telegram head.
- Enter the actuating command in parameter type and number bytes of the user data head.
- Enter the default of the command in the user data head.

Possible commands in the drive

Command	Drive parameter	Parameter no. in telegram
Drive-guided referencing	S-0-0148	0x0094
Reset C1D	S-0-0099	0x0063
Communications phase 3 transition check	S-0-0127	0x007F
Communications phase 4 transition check	S-0-0128	0x0080
Base load	S-0-0262	0x0106
Set absolute measurement	P-0-0012	0x800C
Load base parameters	P-0-4094	0x8FFE
Communications phase 2 transition check	P-0-4023	0x8FB7
Set absolute dimension emulator	P-0-4032	0x8FC0
Automatic control loop settings	P-0-0162	0x80A2

Fig. 1-26: Commands in drive

Always set parameter type to 0x00. Thus only S and P parameters are possible.

Default in user data byte	Effects
0	clears command
3	starts command

Fig. 1-27: Command default

Note: Command status can be read by writing "0" into the first element of the command parameter.

1.6 Error Messages

The error codes defined in the SERCOS interface specification are used. (See **SERCOS Interface specification, sec. 4.3.2.3 "Error messages in service channel**"). These codes are also used with faulty accessing of control and system parameters.

Error code	Explanation
0x1001	IDN not available
0x1009	element 1 incorrectly accessed
0x2001	name not available
0x2002	name transmission too short
0x2003	name transmission too long
0x2004	name cannot be changed
0x2005	name presently write protected
0x3002	attribute transmission too short
0x3003	attribute transmission too long
0x3004	attribute cannot be changed
0x3005	attribute presently write protected
0x4001	unit not available
0x4002	unit transmission too short
0x4003	unit transmission too long
0x4004	unit cannot be changed
0x4005	unit presently write protected
0x5001	minimum input value not available
0x5002	minimum input value transmission too short
0x5003	minimum input value transmission too long
0x5004	minimum input value cannot be changed
0x5005	minimum input value presently write protected
0x6001	maximum input value not available
0x6002	maximum input value transmission too short
0x6003	maximum input value transmission too long
0x6004	maximum input value cannot be changed
0x6005	maximum input value presently write protected
0x7002	data transmission too short
0x7003	data transmission too long
0x7004	data cannot be changed
0x7005	data presently write protected
0x7006	data smaller than minimum input value
0x7007	data greater than maximum input value
0x7008	data not correct
0x7009	data password protected

Fig. 1-28: Error specification per SERCOS

Error with ASCII Communication

The following error messages specifically occur when communicating with an ASCII protocol!

Error code	Explanation
0x9001	fatal error (symbol cannot be identified)
0x9002	parameter type error
0x9003	invalid data block number
0x9004	"Input cannot be identified"
0x9005	data element number not defined
0x9006	error in write/read (r/w)
0x9007	nonsense symbol in data

Fig. 1-29: Error messages during ASCII communications

Error with SIS Communication

Error during Parameter Transmission

status byte If an error occurs during parameter transmission, then "error during parameter transmission" is signalled in the **status byte**.

Error code An **error code** is transmitted in the first two bytes of the **user data**. It describes the type of error.

The following errors can occur during parameter transmission:

Error code	Explanation
0x0000	no error
0x0001	service channel not open
0x0009	element 0 incorrectly accessed
0x8001	"Service channel presently occupied (BUSY)" The desired acces presently not possible as service channel is busy.
0x8002	"problem in service channel" The requested drive cannot presently be accessed.
0x800B	"Transmission terminated (higher priority)"
0x800C	"Unallowed access (service channel not active)" A new request is started before the last one is completed.

Fig. 1-30: Error messages in serial protocol

Execution and Protocol Acknowledgement

One **status byte** is transmitted with each reaction telegram. The status byte supplies the results of a transmission in the form of a code number.

It generally applies:

Status byte results	Code number
transmission no error	0x00
protocol error	0xF0 ... 0xFF
execution error	0x01 ... 0xEF

Fig. 1-31: Definition of status bytes

Protocol error	Code Number	Error description
"Invalid service“	0xF0	The requested service is not specified or is not supported by the addressed user.
"General protocol violation“	0xF1	The command telegram cannot be evaluated. (**Example**: wrong telegram length)

Fig. 1-32: Definition of protocol error

Execution error	Code Number	Error description
"Error during parameter transmission“	0x01	An error occurred during read/write of a parmeter
"Error during phase transition“	0x02	The specified target phase was not reached

Fig. 1-33: Definition of execution errors

Example:

Write accessing a write-protected parameter **S-0-0106, Current loop proportional gain 1**:

The master is trying to write 0 to the parameter. The drive acknowledges with error message 0x7004 ("data cannot be changed").

Command telegram:

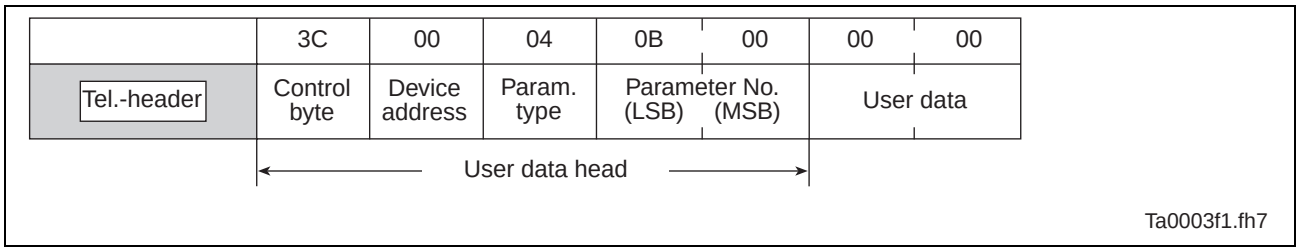


Fig. 1-34: Write S-0-0106 (Command telegram)

Reaction telegram:

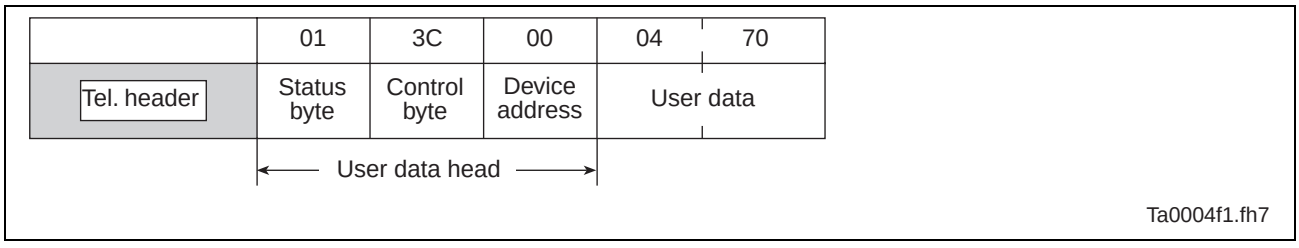


Fig. 1-35: Read S-0-0106 (Reaction telegram)

1.7 Application Examples (Changing Position Block Data)

ASCII Protocol

Suppositions:

- Several drives are connected with a PLC via an RS485 interface. The drive address is 1.
- Drive working in positioning mode. Four positioning blocks are used.
- The target positions of the positioning blocks are to be changed via RS485 interface.

Taking up communications with the relevant drive

BCD:01 (CR)	Command to switch to drive **A01:>** Echo of connected drives. All other drives remain passive.

Note: There is no echo by symbol. Not until after the receipt of the CR does the drive send the entire input sequence back.

Write list of target positions into drive

The target positions of all axes are stored in the form of a list in parameter **P-0-4006, Process block target position**. To change one or more values in this list, it is necessary to write all relevant values of this list. If, therefore, four target positions are used, then all four positions must be written even if only one position is changed.

Drive reaction:		**Input:**		
P-0-4006,7,w,>				(CR)
?	*100.0 (CR)*	target	position	block0
?	*200.0 (CR)*	target	position	block1
	etc.			
?	*<(CR)*			
A01:>				

SIS Protocol

Parameter read access (Service 0x80)

A single read acces is concluded with 1 transmission step. The master enters the following information into the command telegram:

- The desired element is selected in the **control byte** in bits 3-5 "Element". Bit 2 is set to '1' (last transmission).
- The unit **address** is entered.
- **Parameter type and number** are entered.
- No user data are transmitted.

The answer to a read access is put together as follows:

- The acknowledgement to a request is written in to the **status byte**.
- The **control byte** is read out of the command telegram and copied into the reaction telegram.
- The unit **address** is read out of the command telegram and copied into the reaction telegram.
- The requested data is written into the **user data**.

Example:

Read parameter S-0-0044 (Velocity data scaling type) out of drive with address ‘3’. The value of the parameter is 0x0042.

Command telegram:

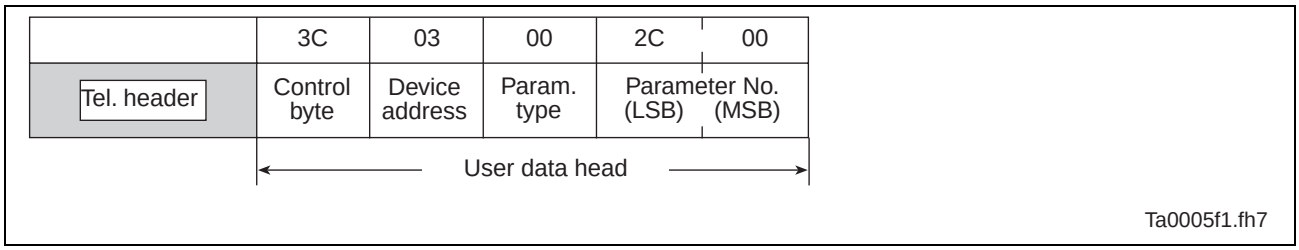


Fig. 1-36: Read S-0-0044 (Command telegram)

Reaction telegram:

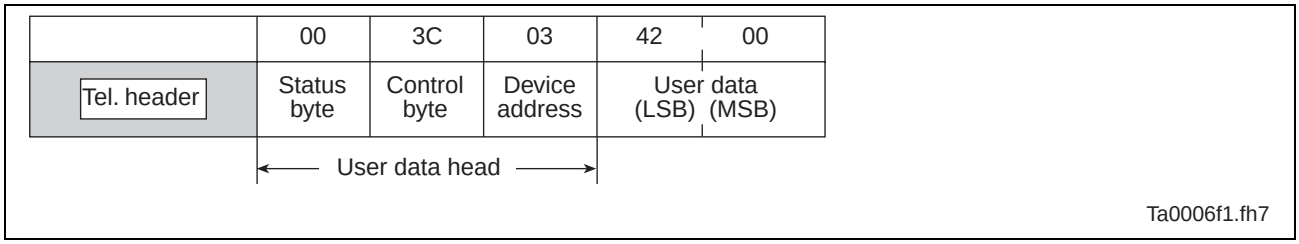


Fig. 1-37: Read S-0-0044 (Reaction telegram)

Read acces with following telegrams (Service 0x01)

Parameters or elements with a length exceeding maximum data field length of 245 bytes are read in several steps. Bit 2 in the control byte (Reaction telegram) designates the current transmission step as either **running** or **last** transmission.

The following is the control word for a transmission in several steps.

1st step:

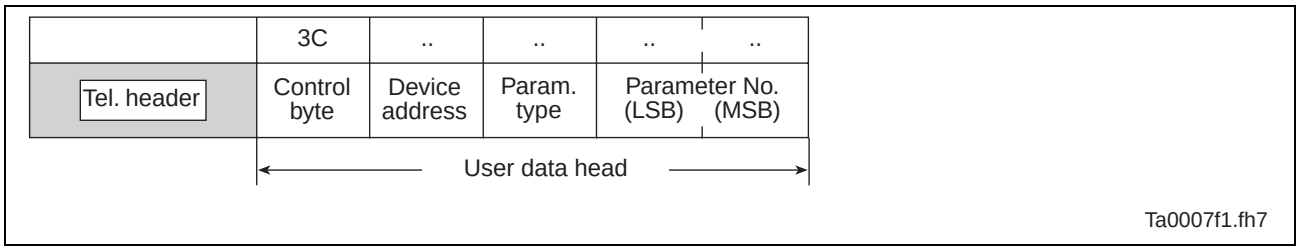


Fig. 1-38: Following command telegram 1

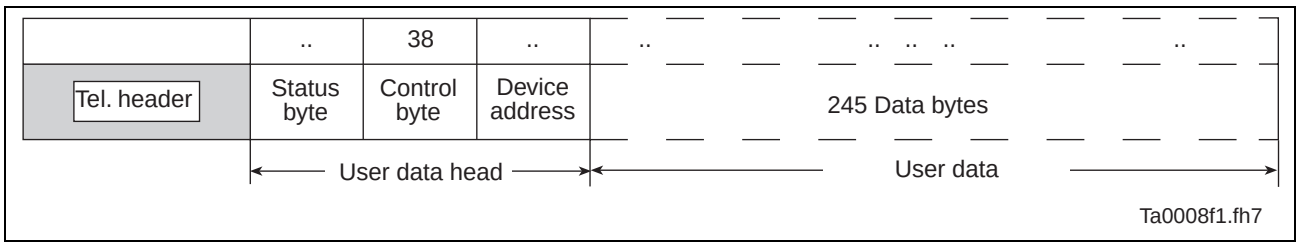


Fig. 1-39: Following command telegram 1

2nd step:

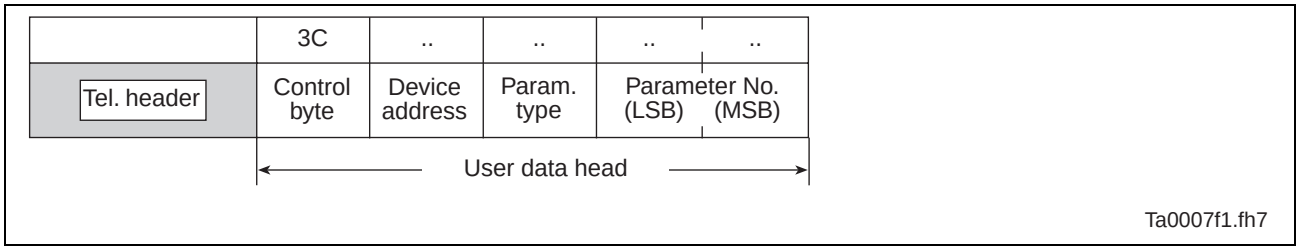


Fig. 1-40: Following command telegram 2

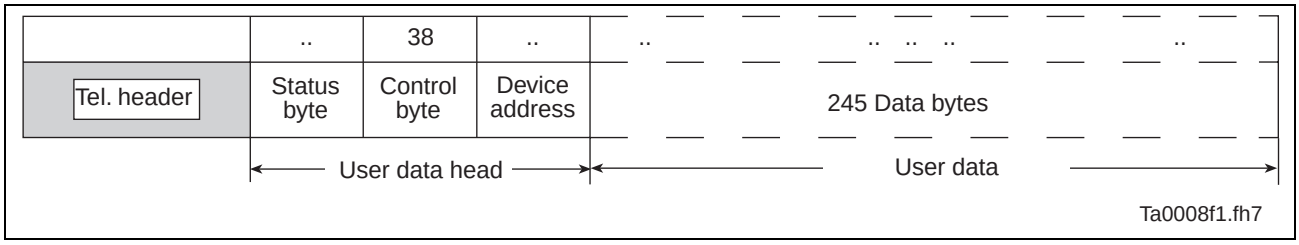


Fig. 1-41: Following command telegram 2

Last step

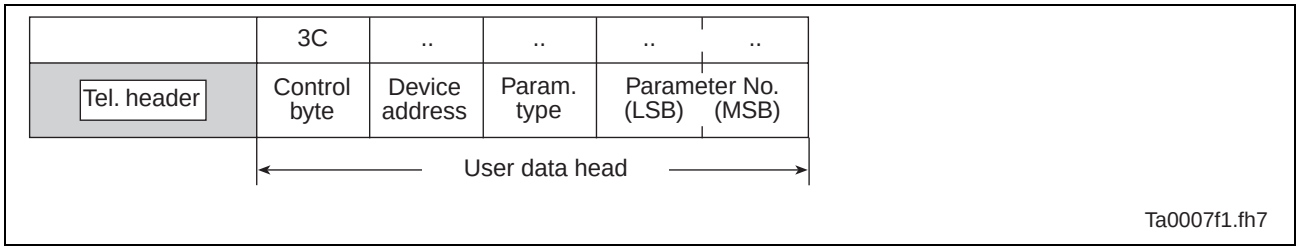


Fig. 1-42: Following command telegram 3

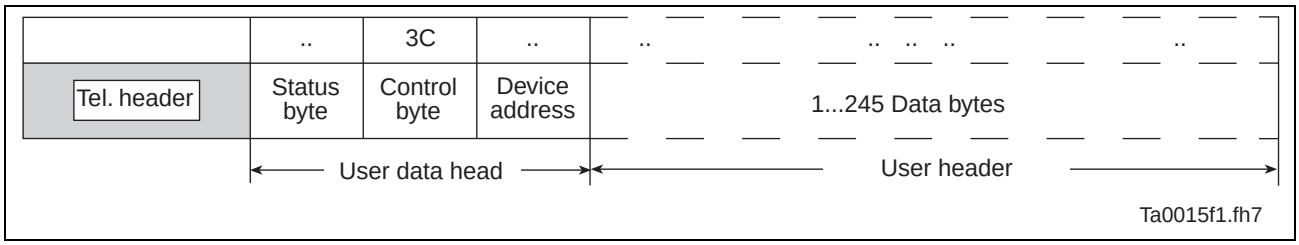


Fig. 1-43: Following command telegram 3

Parameter Write (Service 0x8F)

A single write-access is concluded with one transmission step.

The master enters the following information into the command telegram:

- The unit address is entered.
- In the **control byte** in bits 3-5 "Element" the operating data is selected. Bit 2 is set to '1' (last transmission).
- The ID number of the parameter to be written into the **parameter number.**
- The value of the operating data is entered in the **user data**.

The response to a write accessing is put together as follows:

- The acknowledgement of a request is written into the **status byte**.
- The **control byte** is read out of the command telegram and copied into the reaction telegram.
- The unit address is rad out of the command telegram and copied into the reaction telegram.
- No **user data** are transmitted.

Example:

Transmit parameter S-0-0044 (Velocity data scaling type) to drive with address ‘3’. The value 0x0042 is written into the parameter.

Command telegram:

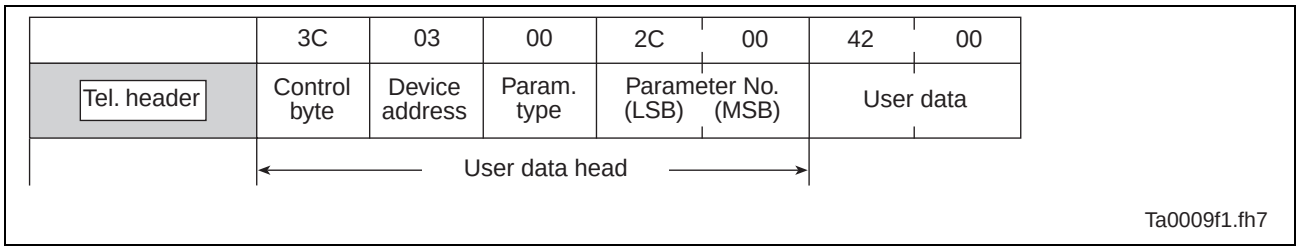


Fig. 1-44: Write parameter S-0-0044 (Command telegram)

Reaction telegram:

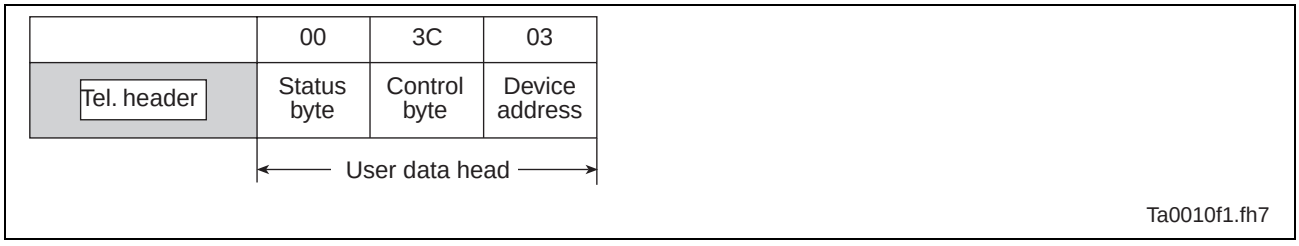


Fig. 1-45: Write parameter S-0-0044 (Reaction telegram)

Write accessing with following telegrams (Service 0x8F)

Parameters or elements with a length exceeding **243 bytes**are read in **several steps**. A transmission of lists of this kind are performed in several steps. Bit 2 in the control byte identifies the current transmission steps as either **running of final** transmission.

The **control word for a transmission in several steps** is described below.

1st step:

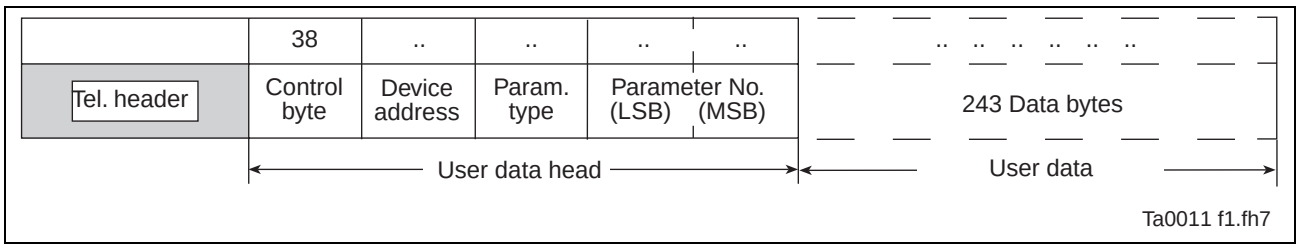


Fig. 1-46: Write following command telegram (step 1)

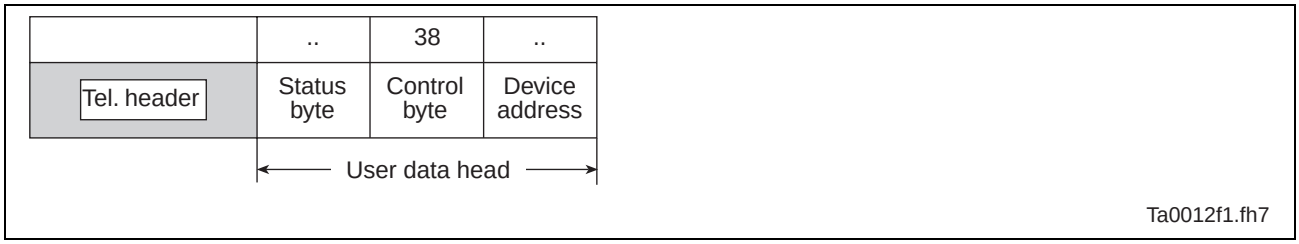


Fig. 1-47: Write following reaction telegram (step 1)

2nd step:

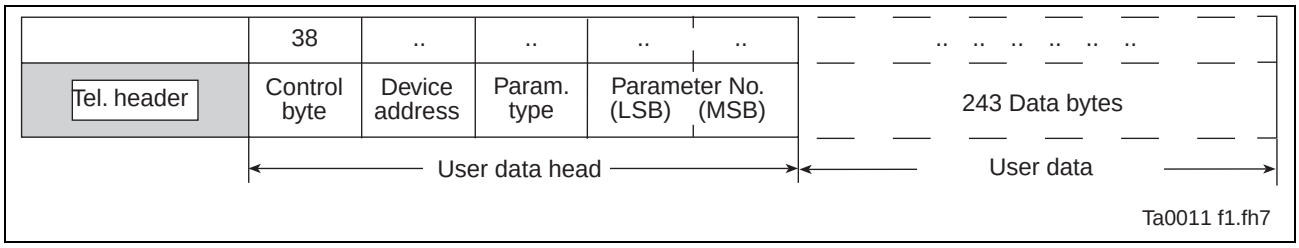


Fig. 1-48: Write following command telegram (step 2)

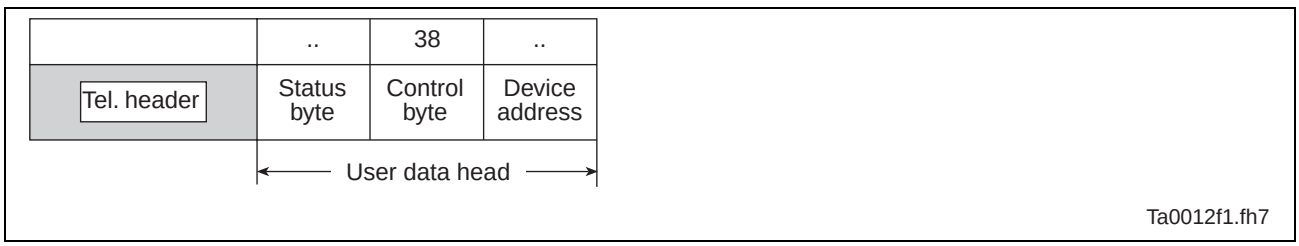


Fig. 1-49: Write following reaction telegram (step 2)

Final step:

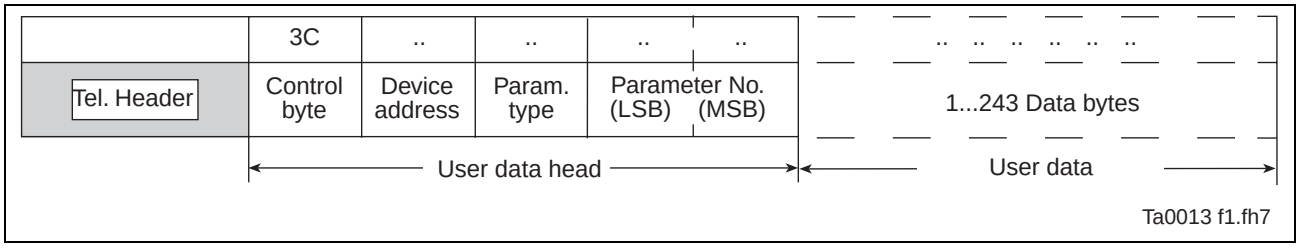


Fig. 1-50: Write with following reaction telegram (step 3)

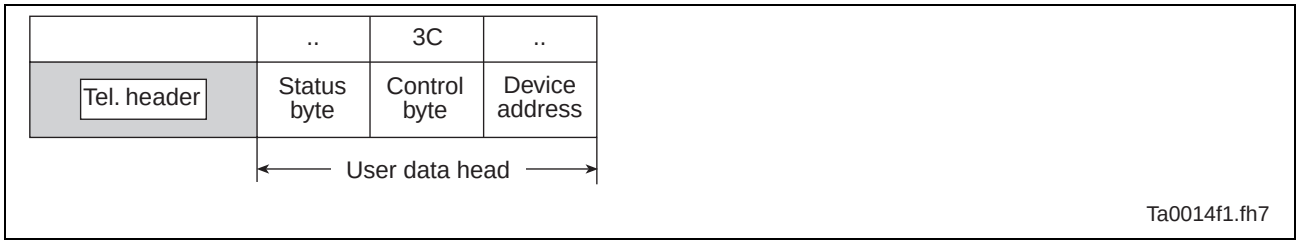


Fig. 1-51: Write with following reaction telegram (step 3)

1.8 Connection Techniques

See Project Planning Manual.

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